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SCLERAL TONOMETRY AND ITS OPTOMETRICAL APPLICATION*

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ABSTRACT

This paper concerns the basis, normals, and technique of scleral tonometry. The importance of this technique to the optometrist in the referral of such cases as glaucoma, cataracts, and decreased tension is discussed. Such alternative methods as palpation, field charting, and gonioscopy are briefly reviewed and evaluated.

The first part of every thorough optometrical examination is the check for pathology. One of the more common serious diseases which must be recognized and promptly referred for medical treatment is glaucoma.

It is extremely important that glaucoma be caught at its incipiency if possible. As glaucoma is a disease characterized by an increased tension it would seem only logical that the earliest means of discovering any increase would be to actually measure it. The typical symptoms of a cupped disc, change in visual fields, extreme pain, and loss of vision are merely evidences that the hypertension is already of some duration. In fact, some ophthalmologists, realizing the large amount of refractions performed by optometrists and their opportunities to discover early glaucoma, have recommended that optometrists be allowed to use anesthetics if only for the purpose of checking intra-ocular tension. However, with the introduction of the scleral tonometer a quite reliable method is now available to optometry for that purpose.

There has been considerable written on corneal tonometry, but as very little can be found in any text books on scleral tonometry it might be best to examine the premise on which such measurements are based. First of all it might be wise to state Pascal's principal concerning fluids. *Pressure is transmitted equally in all directions throughout a mass of fluid at rest, or if pressure at any point is increased, it is increased every-*

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where throughout the fluid mass by the same amount. Keeping this principal in mind and remembering the anatomical construction of the eye, it would seem obvious that tension could be measured on the sclera as well as the cornea with the added advantage that no anesthetic would be required for taking the scleral tension. The only thing which might complicate this procedure would be the thickness and rigidity of the sclera. Measurements on enucleated eyes show that the cornea and sclera are very nearly the same thickness on the anterior portion of the eyball. The sclera does measure much thicker in the area of the optic nerve, however. The rigidity, studied from its embryological development, should be very little different in the cornea or sclera. A comparison of the corneal scale with that established for the sclera does reveal a difference in the two, however. On the Bailliart type tonometer, which can be used for taking either scleral or corneal tension, this difference can be easily seen. The unit of measurement in tonometry is a millimeter of mercury, and a comparison of some of the corneal and scleral readings taken from the Bailliart tonometer is shown below.

CORNEAL SCALE (tension in mm. hg)		SCLERAL SCALE (tension in mm. hg)
10	=	10
15	=	18
20	=	25
30	=	42
40	=	58
50	=	70

It is apparent from research done by Dr. Bailliart of Paris, France, to establish normals for scleral tension that the pressure necessary to indent the sclera is greater than that required to dent the cornea the same amount.

Besides the ophthalmoscope and tonometer there are, of course, other means available to optometrists to check the results of increased tension or the actual tension itself. However, these are either unreliable or too expensive for the average optometric practice. Palpation, for example, is considered by most authorities as a rough estimation at best. May[1] has this to say concerning it, "Estimation of the degree of tension with the fingers merely gives a rough idea, and excepting when the eyeball is very hard or very soft, cannot be relied upon."

As valuable a technique as field charting can be to an optometrist, it must not be relied upon to detect early increases in tension. Traquair[2] cites two cases with a considerable increase in tension but relatively little

changes in the fields. In one case, 70 mm. of mercury (Schiøtz) pressure existed for some months producing wide cupping but no pallor and only slight central depression of the fields. In another case symptoms existed for ten years causing cupping but no pallor and only early field changes. He further warns that since field changes are the result of the glaucomatous process and by no means an early result, it is evident that their detection indicates that the disease is already established. The field changes are becoming more and more useful, however, in confirming rather than initiating the diagnosis, and should always be taken in cases of increased tension. The fields are invaluable in the prognosis of the disease, and should be considered a valuable adjunct of tonometry in all cases of glaucoma.

The gonioscope is a cleverly designed instrument which permits a thorough examination of the anterior chamber including the inner limbus and Schlemm's band. It is particularly valuable in the diagnosis of primary glaucoma, enabling detection of anterior synechiae. The increased angle, which allows for examination of these parts of the anterior chamber, is made possible by a contact lens designed for use with the gonioscope. Its limited application by the optometrist makes it too costly at present, however. Its value is increased for the ophthalmologist in his prognosis and operative work not only in glaucoma but in work with foreign bodies, iritis, traumatic lesions, inflammatory changes, etc.

While the main use of the tonometer is to detect the increase in tension of ordinary glaucoma it is extremely valuable for surgical referral in cataract cases as well. There is a type of secondary glaucoma accompanying hypermature cataracts which would be extremely difficult to detect except by actually measuring the tension. Most optometrists have experienced the problem of just when to refer cataract cases; and having once referred the case of having it sent back "to become ripe." Medical treatment is being used successfully in a few early cataract cases, and modern surgical technique now enables the patient to be operated upon as soon as the cataract interferes with his vision. This has considerably lessened the chances of secondary glaucoma due to the swelling of the crystalline lens with its subsequent increase in intra-ocular tension. However, the possibility still exists that enough increase in tension might arise at a fairly early stage of cataract development—provided that a sufficient lens swelling and hardening accompanies it—to warrant an immediate operation. It would seem safest from an optometric viewpoint to check tension in any beginning cataract to establish a normal for that patient. Any change in tension can then be noted from time to time as the cataract is observed for any further development.

According to Berens and Zuckerman[3] tonometry is also of value

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in determining the decrease in tension which accompanies some eye diseases and general physical conditions. Lowered tension may occur in some cases of detached retina, chronic inflammation of the inner eye associated with shrinkage and disorganization of the eyeball, in nervous diseases such as herpes zoster (disease of the trigeminal nerve), as well as in some general bodily diseases such as general debility, toxic states, diabetic coma, pernicious anemia, and agranulocytosis. The frequency with which lowered intra-ocular tension accompanies these diseases is not discussed. However, if the history of the patient reveals the possibility of any of the above-mentioned diseases it is a matter of only a few seconds to check the tension with a scleral tonometer.

As valuable as the tonometer can be, though, it must be accepted with certain reservations. Most all authorities on tonometry issue a word of warning either regarding the variability inherent in tonometry itself or the care which must be exercised in its instrumentation. Zoethout[4] defines the tonometer as an instrument which indicates the pressure inside the eyeball by the force necessary to press a certain area of the sclera inward. He further says that while this method is open to many sources of error it is practically the only means of obtaining the intra-ocular pressure in the human eye. It must also be recognized that there are a few people on whom even scleral tonometry cannot be done without an anesthetic. This seems to be true only on those few so-called "nervous types" who assert that they just cannot stand anything around their eyes.

Berens and Zuckerman[3] list several common types of tonometers. Schiøtz, McLean, Souter, Gradle, Harrington, and Bailliart are designed for corneal measurements. The Schiøtz, which they consider the most accurate, is provided with three weights to be interchanged so as to provide the most reliable reading. They list the normal variations for the Schiøtz as between 16 and 25 millimeters of mercury; above 25 is considered suspicious and above 28 is considered pathologic. No normals are given for the scleral tonometer, but they do have this to say regarding it. "The scleral tonometer (Bailliart) may not be so accurate as the corneal tonometer, but it may be used without an anesthetic, and it is particularly useful for measuring tension of patients who are nervous or whose corneas are misshapen or abnormal." *The optometrist, however, is not interested in accuracy to within a millimeter or two of mercury. He is mainly concerned with recognition of the disease for prompt referral.*

Proper instrumentation, of course, greatly increases the value of the tonometer. Extreme care must be exercised in the use of the scleral tonometer to assure proper positioning on the eyeball. It should be

placed within 3 to 5 millimeters of the limbus on the temporal side. The pressure must be exerted evenly and firmly toward the center of the eyeball with great care to avoid tilting the instrument. While it is wise to always check the first reading, Tasman[5] warns against repeating the reading several times. Frequent repetition has a tendency to result in lowering the subsequent findings. This would, of course, defeat the purpose of the test and could be performed much better at another time if there was any doubt concerning it. It is also necessary to have the patient fixate on a definite object in the room to avoid movement of the eye during the process. This facilitates the procedure and should help to eliminate any danger of injuring the sclera. Because of the ease and rapidity with which the scleral tonometer can be applied, which is less than 30 seconds on the average patient, it should be used at the completion of any case where there is even the slightest suspicion of glaucoma.

While many other types of tonometers could undoubtedly be adapted to scleral readings, the Bailliart is the only type (with which the writer is familiar) that has readings which can be taken directly from the scleral tension. Dr. Bailliart* lists the normals of his instrument as between 18 and 20, and nearer 20. This was confirmed by the writer also in a series of fifty tests taken on normal refractive cases in which the tension ran from 17 to 26. The normal was found by averaging the fifty cases with a mean result of 19.2. It is impossible to record tension on the Bailliart tonometer closer than one degree. It would be safe to regard anything around 27 on this instrument as suspicious, and above 32 as pathologic. These estimates have not been established clinically and it is safest to establish a normal for each individual case when any question arises. The reading on this instrument is taken when the sleeve is depressed just far enough down the shaft to allow the groove to show above it.

A vital part of tonometry is the proper recording of the findings. The time of day should be listed with every reading recorded from the tonometer. In any suspicious cases it is best to take the tension both morning and night. If a difference of over 3 mm. of mercury exists between the two readings, glaucoma should be suspected. It is also wise to list the mental state of the patient if unduly depressed or upset emotionally.

Questionable cases, in which glaucoma is suspected but difficult to definitely ascertain, can, many times, be solved by artificially exciting the glaucoma. Berens and Zuckerman[3] suggest several so-called provocative tests. Those which could easily be adopted by optometrists are listed.

*According to a letter received July 17, 1947, reporting an interview between Jos. J. Margules (Soft-Lite Lens European representative in Paris) and Dr. Bailliart, the designer of this instrument.

Darkness—Normally the tension rises about 2 mm. of mercury after leaving the patient in a dark room from 40 to 60 minutes. An increase of over 6 mm. is indicative of glaucoma.

Elevation of Blood Pressure—A cup or two of black coffee may cause a rise of tension from 15 to 25 mm. about 20 minutes after drinking.

Water Test—Direct the patient to drink a quart of water immediately after breakfast. In glaucomatous eyes tension will often rise from 6 to 15 mm. of mercury.

Massage Test—In the glaucomatous eye tension will not be lowered appreciably by massage. In the normal eye, one minute of massage results in a lowering of the tension from a third to a half of the reading before the massage.

Glaucoma is another disease thought by many authorities to be on the increase due to the nervous pressure of modern living. Mittelman[6] says that while the personality types have not been investigated in detail the intra-ocular pressure usually rises during periods of worry, shame or resentment. In addition to medical treatment and operations when necessary he recommends psychotherapy in many cases.

Optometrists have, as a duty to their patients, the responsibility of ruling out any diseased condition of the eye before undertaking their work. It is hoped that more research can be stimulated to add to our knowledge of scleral tonometry and its peculiar adaptation to the optometric examination so that glaucoma can be accurately diagnosed at its earliest inception.*

SUMMARY

Glaucoma, one of the most serious eye diseases, can be recognized earliest by taking the intra-ocular tension. Scleral tonometry is proposed as an optometric means of recognizing the first characteristic of this disease. Pascal's principal and the anatomical construction of the eye are cited to prove that tension can be taken on the sclera as well as the cornea. That some differences in tension between the sclera and cornea do exist is revealed by the scales on the Bailliart type tonometer. Palpation, visual fields, and gonioscopy are reviewed as means of recognizing glaucoma. Tonometry's value in cataract referral cases, and in cases of lowered tension is discussed. It is recognized that there are certain errors inherent in scleral tonometry, but that it is accurate enough to enable the optometrist to more intelligently refer his patients for

*Since writing this paper, the Wolfe Foundation of Marshalltown, Iowa, has developed a scleral tonometer which may soon be available to the profession.

medical treatment. The technique of scleral tonometry, its normals and methods of recording, are discussed. It is noted that glaucoma is on the increase, and the optometrist's obligation to discover it as early as possible is restated.

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ABSTRACTS

CRITERIA IN CONTACT LENS FITTING, A. E. Hoare, The Optometric Weekly, 38, 47, 1747-1749, 1947.

Hoare discusses contact lenses from the standpoint of the optometrist and patient, and calls first for manufacturers of contact lenses to set up standards covering the physical and laboratory phases of this work. At present Hoare finds little standardization among the makers of contact lenses.

The author then discusses the legal requirements of contact lens fitting and finds much to be done to clarify the exact position of optometry. He next discusses the physical condition of eyes to be fitted with contact lenses. Here he finds a close relationship between optometrists and ophthalmologists of value.

Hoare then reviews the physical fit of the lens. He points out that some optometrists want the lens to fit as tight as a glove while others seem to prefer it to slide about like a mitten. He suggests that careful criteria of physical fit be arrived at by those prescribing contact lenses.

The author reviews such points as the thickness of the lens itself, the buffer solution to be used, the type of mold and the resultant cosmetic effect of the lenses. In each he finds no wide agreement and a need for clarification of techniques and standardization of procedures.

More thought, too, should be given the very important matter of the lens effect upon refraction and the extra-ocular muscles.

From the patient's standpoint the subjective reaction of the patient is important claims Hoare. He urges extreme caution and advises optometrists to fully point out difficulties to the patient before prescribing the lenses. He says, "Any setback that the practice of contact lens fitting may have suffered can be traced, in large measure, to the over-optimism of the patient, and the equally unfortunate over-enthusiasm of the professional personnel."

The paper concludes with a plea for a standardized "fool-proof" contact lens, at a much lower fee to the patient. C. C. K.

HEADACHE, I. Zimmerman, The Optometric Weekly, 38, 46, 1713-1716, 1947.

To differentiate between headaches of ocular origin and others, the author presents, in chart form, the types of headaches, these being reflex, toxic, abnormal intracranial pressure, circulatory disorders of the brain, neuroses, and diseases of the skull and teguments. In each he presents the site of pain, intensity, character, onset and course, associated phenomena, cause and diagnosis. The frontal and supra-orbital headaches are those usually associated with an ametropia or an imbalance of the accommodative convergence relationships. C. C. K.

A CHANGE IN STATIC REFRACTION AS THE BLOOD SUGAR VARIES—A CASE REPORT*

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Mrs. W. was first seen May 20, 1938, for an ocular examination and refraction.

Her major complaint was extreme discomfort of the right eye. This eye, she said, had been practically blind as long as she could remember.

The ophthalmoscopic findings were negative. Preliminary examination showed both a corrected and uncorrected visual acuity at 6 meters on the Snellen chart of: O. D. 20/400 and 0. S. 20/20. The correction worn previously was: O. U. —0.25 D. cyl. axis 180. Bifocal add. O. U. + 1.50 D. Sph.

The static refraction with the skiascope was as follows:

O. D. — 6.50 D. Sph. ⌒ — 2.00 D. Cyl. Axis 30.

O. S. Plano.

The maximum acuity was obtained with the following correction:

O. D. — 7.00 D. Sph. ⌒ — 2.00 D. Cyl. Axis 30. Acuity 20/25.

O. S. — 0.25 D. Cyl. Axis 180. Acuity 20/20. Add O. U. + 2.00 D. Sph.

Even though Mrs. W. was carefully apprised of the problems that might be encountered by the correction of this much anisometropia, she wore the above correction with a high degree of comfort until June 17, 1940, when she returned for a routine ocular examination and refraction.

There was no major change in the findings and the following correction was given:

O. D. — 7.00 D. Sph. ⌒ — 2.00 D. Cyl. Axis 30. Acuity 20/20.

O. S. + 0.25 D. Sph. ⌒ — 0.25 D. Cyl. Axis 100. Acuity 20/16. Add O. U. + 2.25 D. Sph.

Mrs. W. called September 29, 1940, and complained that her

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vision at both distance and near was blurred and had been getting progressively worse for the past several days.

On September 30, 1940, when re-examined, the following changes were noted: Visual acuity through the correction of June 17, 1940, as follows:

O. D. 20/50.
O. S. 20/40.

The static refraction with the skiascope was now as follows:
O. D. — 6.00 D. Sph. ⌒ — 2.00 D. Cyl. Axis 30. Acuity 20/20.
O. S. + 1.50 D. Sph. Acuity 20/16. Add. O. U. + 2.25 D. Sph.

No change in her correction was made at this time. Mrs. W. was advised to consult her physician at once for a medical examination. His examination of the urine showed sugar and an immediate blood sugar showed 250 mgms. per 100 cc. of blood. His diagnosis of her case was diabetes. Both a diet and insulin were prescribed by the physician. Subsequent blood sugar tests were made and the necessary adjustments in the insulin dosage made.

Mrs. W. called within a few days and advised that her vision was again very clear at both distance and near. She did not return at this time for further ocular examination.

Mrs. W. returned June 24, 1943, for a routine ocular examination and refraction. The findings were the same as of June 17, 1940. No change in the correction was made.

Under the direction of her physician, Mrs. W. took the prescribed insulin from September, 1940, until her death in 1945.

CONCLUSION

Pathological changes of the eye due to diabetes are extensively described by many authorities.

There is very little written concerning changes in the static refraction of the eye during the course of this disease. Hess and others have computed the change in the total refraction of the eye as the indices of the media are increased as would be the case in an increased sugar content.

An increase in the indices of the media through an increased sugar content would produce the following tendencies in the total refraction of the eye.

1. If the index of the aqueous humor is increased with no change in the index of the vitreous humor, the eye will become more myopic or less hyperopic.

2. If the index of the vitreous humor is increased with no change in the index of the aqueous humor, the eye will become more hyperopic or less myopic.

3. If the index of both the aqueous humor and the vitreous humor are increased equally, the eye will become more hyperopic or less myopic.

4. If the index of the crystalline lens is increased equally throughout and the aqueous and vitreous remain the same, the eye will become more myopic or less hyperopic. Unequal changes in the index of the lens could under certain circumstances produce an increased hyperopia or a decreased myopia.

5. The amount and direction of the change in static refraction of the eye can be altered considerably through unequal changes in the indices of the media and/or the crystalline lens.

ABSTRACTS

OCULAR DOMINANCE. L. J. Hartley. The Associated Journal of Optometry, 13 (5), 14-15, April, 1948. (Reprinted from the Australasian Journal of Optometry.)

Ocular dominance is closely related to handedness and the same eye is dominant usually for both distance and near. Two methods of determining ocular dominance are presented. One method requires that the patient hold with both hands a card containing an aperture so that when it is raised at arm's length before the eyes, only one eye (the dominant eye) fixates the target. The second method makes use of a near-point rule and a sliding septum which hides from view a vertical line drawn upon a near-point card. The septum is moved toward the patient until the vertical line is seen by one eye which is taken to be the dominant eye.

The author believes that ocular dominance is subject sometimes to change due to improper refractive corrections. He also suggests in the prescribing of prisms that the greater amount be placed before the non-dominant eye. In general, it is recommended that the visual acuity of the dominant eye be left superior, except where: "(a) No glasses have been worn and the vision of the dominant eye has been worse for some time: (b) Pathological conditions prevent; (c) It is impossible to make the visual acuity of the dominant eye superior without unduly sacrificing that of the other." R. E. B.

TACHISTOSCOPIC TRAINING IN SCHOOLS. F. M. Root, and D. O. Root. The Optometric Weekly, 38, 52, 1925-1927, 1947.

A group of three girls and three boys were selected for tachistoscopic training to develop improved visual perception and reading speed. These subjects were all sixth grade students who had previously shown an inadequacy in reading. A similar control group was established. The initial group was given a series of thirty ten-minute training periods. The equipment used was the American Optical Company tachistoscope. At the end of these training sessions, the group which had been treated showed a 15 per cent improvement in reading ability over the control group. Tables are presented by the authors showing their findings. C. C. K.

VISUAL SURVEY OF EAST CANADIAN ARCTIC ESKIMOS. A. H. Tweedle. The Optical Journal and Review of Optometry, 84, 21, 36-39, 1947.

To determine the presence of ocular pathology as well as the incidence, degree and type of ametropia among the Eskimo people of the Eastern Canadian Arctic region the author, accompanied by an ophthalmologist and nurse visited a number of trading posts in the far north where 183 Eskimo patients were examined and refracted. Of these, 137 required corrections to offset refractive errors which were present. About 80 per cent of the ametropia was found to be either hyperopia or presbyopia. The author does not give the ages of his patients but indicates many were presbyopic. Tweedle served as optometrist of the expedition and did the refracting. C. C. K.

COMPENSATORY CYCLO-TORSION ACCOMPANYING HEAD TILT*

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The question of whether or not a lateral tilting of the head results in a compensatory cyclo-torsion of the eyeball has been the subject of much discussion and investigation during the last 125 years.

Among the first to investigate this matter was John Muller. About 1826, he wrote of placing ink dots on the white of the eye so that he could observe its movements. In all his observations, he failed to notice any rotation of the eyeball about its longitudinal axis.[1]

A few years later, about 1842, Hueck defended the viewpoint of Hunter, a previous investigator, by saying that when the head was tilted toward the shoulder an opposite rotation of the eyeball took place around the visual axis so that the meridian of the retina, which is vertical in the ordinary circumstances of life, remains vertical. This viewpoint was supported by Tourtual, 1842; Burow, 1843; Valentin, 1844; Krause, 1846, and Volkmann, 1846.[1,2]

In 1851, Ruete claimed that by means of after-images he had found that tilting the head without moving the eye with respect to the head does not cause a rotation of the eyeball. This viewpoint was supported by Donders, 1855, and by Helmholtz, 1857.[1,2]

In 1866, Javal demonstrated that the eye performs a slight rotation. He had observed that when he leaned his head to the right or to the left the direction of the axis of his cylindrical glasses no longer coincided with his astigmatism. This viewpoint was in turn supported by A. Nagel, 1871; Skrebitzky, 1871; Woinow, 1871; Mulder, 1874; Donders, 1876, and W. Nagel, 1878. Of these, Mulder, Kuster, Skrebitzky, and W. Nagel made actual measurements which will be discussed later.[1,2]

In 1894, Contejean and Dalmas declared that no rotation of the eyeball occurred when the head was tilted.[1]

In 1906, Stevens[3] stated that rotation does take place.

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The next reference to this matter was made by Duke-Elder[4] in 1939, who stated that movement does occur. He claimed that the static reflexes—the "Tonic Labyrinthine Reflexes" affected by the position of the head in space and the "Tonic Neck Reflexes" affected by the position of the head in relation to the neck—cause this movement. He writes as follows:

"The movements initiated by both types of reflexes are compensatory in nature, tending, so far as the eyes are concerned, to return the visual fields as far as possible in its normal orientation, and when both are active the total effect is the algebraic summation of the two influences, the final result being the almost complete compensation by the eyes of all head movements in all directions." Lancaster[5] in 1943, and Emsley[6] in 1946, wrote in support of this statement claiming that the postural reflexes attempt to straighten the eyes. Lancaster states:

"Cycloversions are especial manifestations of labyrinthine and proprioceptive control; for example, in tilting the head toward the right shoulder, a reflex levocycloversion occurs."

Thus we find the authorities very definitely divided in opinion as to whether or not a head tilt will cause compensatory cyclo-torsion of the eyeballs. Since 1900, all authorities feel there is a torsion but they are not in agreement as to the amount. It is the purpose of this paper to investigate this matter and to measure quantitatively whether or not there is such an effect.

We have attempted to determine the effect by both objective and subjective methods.

A. OBJECTIVE DETERMINATION

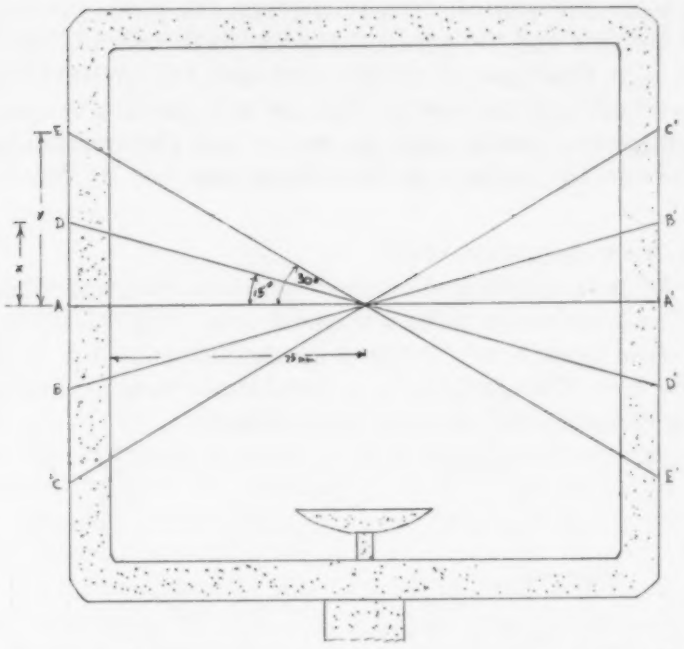
The American Optical Company "CI" ophthalmometer was used for this part of the investigation. Fine threads were fastened to the side bars of the head rest apparatus in the following positions, as viewed by the observer.

0-180 designated as AA′
15-195 designated as DD′
30-210 designated as EE′
345-165 designated as BB′
330-150 designated as CC′

As viewed by the patient:

0-180 designated as A′A
15-195 designated as B′B
30-210 designated as C′C
345-165 designated as D′D
330-150 designated as E′E

The horizontal distance between the head rest bars was 155 mm.



$$\text{Tan } 15° = \frac{x}{75} \qquad \text{Tan } 30° = \frac{y}{75}$$

$$x = 20.76 \text{ mm} \qquad y = 44.74 \text{ mm}$$

Fig. 1.

Head rest apparatus arranged for objective determination of cyclo-torsion. Viewed from observer's side.

The positions the threads were to occupy on the bars were computed as follows:

$$\text{Tan } 15° = \frac{x}{130} \qquad \text{Tan } 30° = \frac{y}{130}$$

$$x = 34.8 \text{ mm} \qquad y = 75.05 \text{ mm}$$

A thin wooden block was fastened across the head rest knobs to give a more even resting surface.

The following procedure was used in each case:

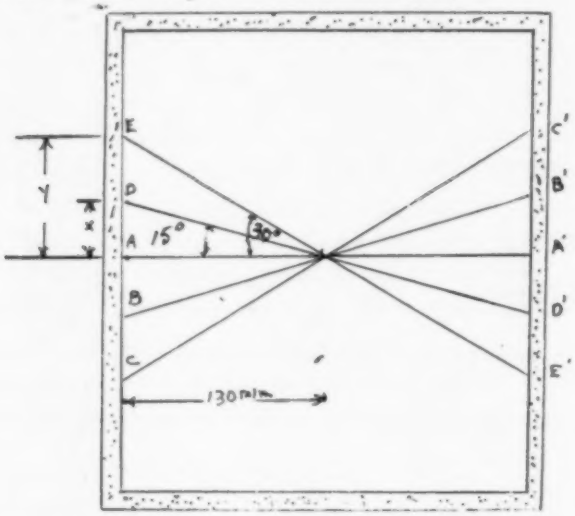
The subjects picked were persons showing at least 1.00 diopter of corneal astigmia. This was done to facilitate the determination of the principal meridian. Three sets of readings were taken on each subject as follows:

The outer canthi were aligned with thread AA′ and the primary principal meridian was determined. The head was tilted 15° to the right and the canthi aligned with thread BB′. The position of the primary principal meridian was again determined. The head was then tilted 15° to the left, the canthi aligned with thread DD′ and the primary

meridian again determined. In like manner the head was tilted 30° right and 30° left and the canthi aligned with threads CC′ and EE′ respectively. The three sets of readings for each subject were then averaged. The amounts of movement of the primary meridian right and left were added together and divided by two to give the average change for a 15° head tilt. In the same manner the average for 30° head tilt was determined.

B. SUBJECTIVE DETERMINATION

An American Optical Company projecto-chart and Cohen slide were used in conjunction with a special frame. Fine threads were fastened across an open frame in the same meridians as for the objective part of the test. The positions for the threads were computed in the same manner as for the objective determination.



$\text{Tan } 15° = \frac{x}{75}$ $\qquad$ $\text{Tan } 30° = \frac{y}{75}$

$x = 20.76$ mm $\qquad$ $y = 44.74$ mm

Fig. 2

The following procedure was used in each case:

Each subject was tested three times, the subjects being the same as for the previous part. The head was held straight, the outer canthi aligned with thread AA′, and the position of the darkest line on the Cohen slide determined. Each patient was fogged slightly so as to make the meridian of greatest refraction stand out more prominently. The head was tilted 15° to the right, the canthi aligned with thread BB′ and the position of the darkest line again determined. Then the head was tilted 15° to the left, the canthi aligned with thread DD′ and the same

procedure repeated. The same procedure was also followed for 30° right and for 30° left tilts, the canthi being aligned with threads CC′ and EE′ respectively. The results of the three tests were then averaged. The amounts of movement of the darkest line right and left were added together and divided by two to determine the average change for a head tilt of 15°. In like manner the average movement for a 30° head tilt was also determined.

RESULTS

The results of the objective determinations have been tabulated in Table A. The fourth column shows the position of the primary meridian for each of the 31 subjects. The next two columns represent the positions of the primary meridian for 15° right and for 15° left head tiltings. The next two columns show the same thing for 30° right and 30° left tilts. Columns 9 and 11 show the average turnings of the primary meridian for 15° and 30° head tilts. Columns 10 and 12 show the amounts of compensatory cyclo-torsion for the two conditions. The maximum and minimum cyclo-torsions in each case were 5.84° and 4.34° for the 15° tilts and 10.67° and 8.50° for the 30° tilts. The means were 4.9971° and 9.8150° respectively.

In order to determine whether these findings fall within the limits of acceptable variability, the Standard Deviations for the 15° tilt and 30° tilt were determined. The Sigma for 15° is 0.334, that for 30° is 0.50. We find for the 15° tilt that 71 per cent of the cases fall within 1 Sigma on either side of the mean, while all cases for 15° tilt fall within 2.25 Sigma on either side of the mean. For 30° tilt, 68 per cent of the cases fall within 1 Sigma on either side of the mean while all cases for 30° tilt fall within 2.15 Sigma on either side of the mean.

We have chosen for our range of variability ± 0.5° for 15° tilt and ± 1.0° for 30° tilt. Referring to Table C, we find for 15° tilt a maximum of 5.49° and a minimum of 4.49°, and for 30° tilt a maximum of 10.81° and a minimum of 8.81°. We find 90 per cent of the cases for 15° tilt and 96.7 per cent for 30° tilt falling within our limits. Thus, for 15° tilt we find a cyclo-torsion of 33.31 ± 3.33 per cent and for 30° tilt we find a cyclo-torsion of 32.71 ± 3.33 per cent.

The results of the subjective determination are tabulated in Table B. The third column shows the position of the darkest line, or the line 90° from it, for each of the subjects with the head held straight. Columns 4 and 5 show the position of the darkest line for 15° right and left tilts. Columns 6 and 7 show the same thing for 30° tilts. Columns 8 and 10 show the average turning of the line for 15° and 30° tilts. Columns 9 and 11 show the average amounts of compensatory cyclo-

TABLE A

Objective Determination of Cyclo-Torsion Resulting from 15° and 30° Head Tilt.

Subject	Eye	Ast. D.	PM	15 R	15 L	30 R	30 L	Avg. 15	Avg. CT.	Avg. 30	Avg. CT.
1	R	4.25	180.00	10.33	169.00	20.00	157.00	10.66	4.34	21.50	8.50
2	L	3.00	7.00	17.00	176.00	26.00	164.00	10.50	4.50	21.00	9.00
3	R	2.25	170.00	180.00	159.33	10.66	150.00	10.33	4.67	20.33	9.67
4	R	2.00	179.33	9.66	169.00	18.66	156.33	10.33	4.67	21.16	8.84
5	R	2.00	175.66	7.00	166.33	16.00	154.00	10.33	4.67	21.00	9.00
6	L	1.25	178.66	8.66	168.00	18.66	158.66	10.33	4.67	20.00	10.00
7	R	2.00	179.66	10.00	169.66	20.00	160.66	10.16	4.84	19.66	10.34
8	R	1.25	5.00	15.33	175.00	25.00	165.33	10.16	4.84	19.83	10.17
9	L	1.50	165.00	175.33	155.00	5.33	145.00	10.16	4.84	20.16	9.84
10	L	1.50	175.00	5.00	164.66	14.33	155.00	10.16	4.84	19.66	10.34
11	R	2.25	172.33	2.33	162.00	13.00	152.66	10.16	4.84	20.16	9.84
12	R	1.00	15.00	25.00	5.00	35.00	175.00	10.00	5.00	20.00	10.00
13	R	1.50	165.00	175.00	155.00	4.66	144.66	10.00	5.00	20.00	10.00
14	L	1.75	174.66	4.66	164.66	14.33	154.33	10.00	5.00	20.00	10.00
15	L	2.50	180.00	10.00	170.00	20.00	160.00	10.00	5.00	20.00	10.00
16	L	2.00	2.00	12.33	172.33	23.00	161.66	10.00	5.00	20.66	9.34
17	L	1.50	145.00	155.00	135.00	165.33	125.00	10.00	5.00	20.16	9.84
18	R	1.50	165.33	175.33	155.33	4.33	145.33	10.00	5.00	19.50	10.50
19	L	3.50	162.66	173.00	153.00	3.00	142.66	10.00	5.00	20.16	9.84
20	L	2.25	14.00	24.00	4.00	33.33	174.00	10.00	5.00	19.66	10.34
21	L	1.75	176.66	7.66	167.66	17.33	157.00	10.00	5.00	20.16	9.84
22	L	3.00	173.33	3.00	163.33	13.66	153.00	9.83	5.17	20.33	9.67
23	L	2.50	170.00	180.00	160.33	10.00	150.00	9.83	5.17	20.00	10.00
24	R	2.00	176.00	5.66	166.00	15.66	154.66	9.83	5.17	20.50	9.50
25	R	2.25	174.66	4.66	165.33	14.00	153.66	9.66	5.34	20.16	9.84
26	R	1.75	175.00	5.66	166.33	15.66	156.00	9.66	5.34	19.83	10.17
27	L	2.00	4.00	13.66	174.66	22.33	163.00	9.50	5.50	19.66	10.34
28	R	3.00	176.33	5.66	166.66	15.33	155.66	9.50	5.50	19.83	10.17
29	R	2.00	7.00	16.66	177.66	26.33	165.00	9.50	5.50	20.66	9.34
30	R	1.50	173.66	3.66	165.00	12.33	152.66	9.33	5.67	19.83	10.17
31	R	3.75	11.33	21.00	2.66	30.33	171.66	9.16	5.84	19.33	10.67

TABLE B

Subjective Determination of Cyclo-Torsion Resulting from 15° and 30° Head Tilt.

Subject	Eye	0	15 R	15 L	30 R	30 L	Avg. 15	Avg. CT.	Avg. 30	Avg. CT.
7	R	90.00	101.00	78.33	111.66	70.00	11.33	3.67	20.83	9.17
4	R	90.00	100.66	79.33	111.33	69.33	10.66	4.34	21.00	9.00
30	R	85.66	95.00	74.00	105.00	64.00	10.50	4.50	20.50	9.50
27	L	90.00	100.00	79.33	110.66	67.00	10.33	4.67	21.83	8.17
29	R	120.00	130.00	109.33	140.00	100.00	10.33	4.67	20.00	10.00
16	L	90.00	100.00	79.33	110.66	68.66	10.33	4.67	21.00	9.00
14	L	89.66	100.00	79.66	110.00	69.66	10.33	4.67	20.33	9.67
24	R	90.00	100.00	79.66	110.66	69.00	10.16	4.84	20.83	9.17
28	R	85.33	95.33	75.00	104.33	66.00	10.16	4.84	19.16	10.84
12	R	90.00	100.00	79.66	110.00	69.66	10.16	4.84	20.16	9.84
6	L	84.66	94.66	74.33	105.00	64.33	10.16	4.84	20.33	9.67
13	R	89.66	100.00	79.66	110.00	69.66	10.16	4.84	20.16	9.84
11	R	92.33	103.00	82.66	112.66	72.66	10.16	4.84	20.00	10.00
21	L	90.00	100.00	79.66	110.66	70.00	10.16	4.84	20.33	9.67
22	L	84.00	94.00	74.00	104.00	64.00	10.00	5.00	20.00	10.00
23	L	75.00	85.33	65.33	95.33	55.00	10.00	5.00	20.16	9.84
15	L	90.00	100.00	80.00	110.00	70.00	10.00	5.00	20.00	10.00
3	R	80.00	90.00	70.00	100.00	60.00	10.00	5.00	20.00	10.00
25	R	90.00	100.00	80.00	110.00	70.00	10.00	5.00	20.00	10.00
8	R	50.00	60.00	40.00	70.33	30.00	10.00	5.00	20.16	9.84
31	R	105.00	115.00	95.00	125.00	85.00	10.00	5.00	20.00	10.00
17	L	127.00	137.00	117.00	146.66	107.00	10.00	5.00	19.83	10.17
18	R	75.00	85.00	65.00	95.00	55.66	10.00	5.00	19.66	10.34
9	L	87.33	97.33	77.33	107.66	67.00	10.00	5.00	20.33	9.67
10	L	90.00	100.00	80.00	110.00	70.00	10.00	5.00	20.00	10.00
20	L	105.00	115.00	95.00	125.00	85.00	10.00	5.00	20.00	10.00
19	L	65.00	75.00	55.33	85.00	45.00	9.83	5.17	20.00	10.00
2	L	94.00	104.33	85.00	115.33	75.00	9.66	5.34	20.16	9.84
5	R	95.00	104.00	85.33	115.00	73.66	9.33	5.67	20.66	9.34
26	R	90.00	100.00	81.33	110.33	70.00	9.33	5.67	20.16	9.84
1	R	88.00	96.66	78.33	107.00	68.00	9.16	5.84	19.50	10.50

TABLE C

Limits of Variability of Objective and Subjective Methods

Head Tilt	Test	Mean	Max.	Mean	Min.	Max.%	Mean %	Min.%	Cases in Limits
15	Obj.	4.9971±0.5	5.49	4.99	4.49	36.64	33.31	29.98	28
15	Subj.	4.9280±0.5	5.42	4.92	4.42	36.18	32.85	29.52	26
30	Obj.	9.8150±1.0	10.81	9.81	8.81	36.05	32.71	29.38	30
30	Subj.	9.7720±1.0	10.77	9.77	8.77	35.90	32.57	29.24	29
15		4.9625±0.5	5.46	4.96	4.46	36.41	33.08	29.75	27
30		9.7935±1.0	10.79	9.79	8.79	35.97	32.64	29.31	29.5
						36.19	32.86	29.53	28.25

TABLE D

Comparison of Objective and Subjective Findings

Subject	15° Obj.	15° Subj.	30° Obj.	30° Subj.
1	4.34	5.84	8.50	10.50
2	4.50	5.34	9.00	9.84
3	4.67	5.00	9.67	10.00
4	4.67	4.34	8.84	9.00
5	4.67	5.67	9.00	9.34
6	4.67	4.84	10.00	9.67
7	4.84	3.67	10.34	9.17
8	4.84	5.00	10.17	9.84
9	4.84	5.00	9.84	9.67
10	4.84	5.00	10.34	10.00
11	4.84	4.84	9.84	10.00
12	5.00	4.84	10.00	9.84
13	5.00	4.84	10.00	9.84
14	5.00	4.67	10.00	9.67
15	5.00	5.00	10.00	10.00
16	5.00	4.67	9.34	9.00
17	5.00	5.00	9.84	10.17
18	5.00	5.00	10.50	10.34
19	5.00	5.17	9.84	10.00
20	5.00	5.00	10.34	10.00
21	5.00	4.84	9.84	9.67
22	5.17	5.00	9.67	10.00
23	5.17	5.00	10.00	9.84
24	5.17	4.84	9.50	9.17
25	5.34	5.00	9.84	10.00
26	5.34	5.67	10.17	9.84
27	5.50	4.67	10.34	8.17
28	5.50	4.84	10.17	10.84
29	5.50	4.67	9.34	10.00
30	5.67	4.50	10.17	9.50
31	5.84	5.00	10.67	10.00

torsion for 15° and 30° head tilts. The maxima and minima in each case were 5.42° and 4.42° for 15° tilts and 10.77° and 8.77° for 30° tilts respectively. The means in each case were 4.93° and 9.77° in the order given.

The standard deviations were again calcuated in each case. For 15° tilt the Sigma is 0.39 and for 30° tilt it is 0.49. For 15° tilt 77 per cent of the cases fall within 1 Sigma on either side of the mean and all cases fall within 2.75 Sigma on either side of the mean. For 30° tilt 74 per cent of the cases fall within 1 Sigma on either side of the mean and all cases fall within 2.70 Sigma on either side of the mean. Here again we have chosen our own limits of variability of ± 0.50° for 15° tilt and ± 1.0° for 30° tilt. Referring again to Table C, we find for 15° a maximum of 5.42° and a minimum of 4.42° and for 30° a maximum of 10.77° and a minimum of 8.77°. We find that 83.6 per cent of the cases for 15° tilt and 93.3 per cent for 30° tilt fall within our limits. Thus for 15° tilt we find a cyclo-torsion of 32.85 ± 3.33 per cent and for 30° tilt a cyclo-torsion of 32.57 ± 3.33 per cent.

Referring to Table D, we find a comparison of objective and subjective findings. It will be noted that in the majority of cases there is a close agreement between the two methods.

TABLE E

Results of Previous Investigations.

Inclination of Head	10	15	20	25	30	35	40
Mulder	—	3	—	4	—	5	—
Kuster	—	4	—	6	—	6.5	—
Skrebitzky	—	2	—	2.6	—	4.2	—
W. Nagel	1.3	—	3.8	—	5.2	—	5.4
Averages	1.3	3	3.8	4.2	5.2	5.2	5.4
%	13	20	19	17	17	15	14

CONCLUSIONS

Our results are somewhat higher than those reported by previous investigators.

Referring to Table E, we find that they report an average of 20 per cent cyclo-torsion for a 15° tilt and an average of 17 per cent cyclo-torsion for a 30° tilt.

We would say that within the limits of our test a tilting of the head of no more than 30° toward the shoulder results in a compensatory cyclo-torsion of 32.86 ± 3.33 per cent

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ABSTRACTS

CONTACT LENS SOLUTIONS. John Collins Neill, Alumni Bulletin, Pennsylvania State College of Optometry, 1 (12): 1-4, April, 1948.

In a comprehensive survey of contact lens solutions, the author states that the haze or halo which develops after the wearing of contact lenses a few hours is caused by an edema of the cells of the cornea which develops as a result of the imbalance in osmotic pressure between the solution and the corneal cells. In an attempt to prolong the haze-free wearing time it was thought that if the osmotic pressure of the contact lens solution could be raised to a point equal to or exceeding that of the fluid in the corneal cells, osmosis of fluid into these cells would be prevented and no corneal edema would occur. At first, practitioners attempted to match the pH of the solution to that of the patient's tears. However, it became apparent that a solution with a pH identical to that of tears was not often so well tolerated as one with a somewhat higher pH.

In recent years, pharmaceutical manufacturers have become interested in the problem of contact lens solutions. Their products are available currently in both capsule and liquid form. However, proprietary solutions are expensive for patients who wear their lenses constantly and must refresh the solution several times daily. The author has given these solutions to many of his patients who wear their lenses constantly and must refresh the solution several times daily. After years of clinical experimentation with the various proprietary and non-proprietary solutions, he concludes that wearing time is influenced but little by any solution so long as it is non-irritating to the eye. The ideal solution seems to be one with a pH of about 8 and an osmotic pressure which approaches isotonicity with the tears. A 1½ per cent solution of sodium bicarbonate meets these requirements reasonably well and is almost universally used today by contact lens practitioners.

Bicarbonate of soda solutions are very unstable and clinical experience indicates that the pH of a bicarbonate solution is raised to an irritating degree in about 3 days at room temperature. Therefore, the author does not dispense contact lens solutions in liquid form. He prescribes capsules of sodium bicarbonate powder and instructs the patient to dissolve the powder in a specified amount of distilled water, purchased in small quantities to insure freshness.

This paper also discusses the use of methyl cellulose in contact lens solutions. When dry, methyl cellulose resembles absorbent cotton, but it disolves to form a viscous crystal-clear solution completely miscible with sodium bicarbonate solutions. The addition of methyl cellulose (0.33 per cent to the usual 1½ per cent sodium bicarbonate solution) gives a contact lens fluid which is well tolerated by the average eye. It adheres to the contact lens surface which helps eliminate the wetting problems; it is slippery and seems to lubricate the action of the lids over the lens, and because of its high viscosity, bubble formation is reduced. However, while solutions containing methyl cellulose have proved to be highly desirable, their use has posed a real problem. A 0.33 per cent solution of methyl cellulose must be filtered before it may be used as the vehicle for a contact lens solution and ordinary filtering methods are not practical. Due to the high viscosity of the solution and its tendency to clog the filter paper, rapid and thorough filtering (using a vacuum filtering apparatus) is possible only in pharmaceutical manufacturing plants.

When a patient wishes to use a methyl cellulose contact lens solution he must obtain the methyl cellulose as a plain aqueous solution and use this in place of distilled water for making up his own solution with the capsules of sodium bicarbonate as described previously. Since solutions of methyl cellulose are very viscous, any air injected into the solution will tend to form bubbles which will remain after it is placed in a contact lens and the lens inserted in position. Any bubbles seen in the solution when it is placed in the contact lens should be carefully worked out before the lens is inserted in the eye. R. E. B.

THE VARIATION OF PHORIA WITH AGE*

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In recent studies the effect on phoria measurements of the stimulus[1,2] and the sequence of testing[3] have been investigated. Another source of variability in the measurement of the phoria is the age of the patient. With reference to this problem, it has been pointed out[4] that: "The idea that exophoria tends to increase with age has been current for a long time and has stood the test of agreement with common experience even if it has escaped statistical investigation." The present study offers such a statistical analysis.

Weymouth, Brust, and Gobar[5] in a study of 175 cases found a low, non-significant correlation between age and phoria. Their conclusion was: "Comparing the balance at near with age, (12 to 80 years plotted in 5-year intervals) a correlation of — 0.021 ± 0.053 is obtained. This value is slightly increased (— 0.039 ± 0.058) by plotting the ages (12 to 39) by year intervals, but not enough to be of any practical value, except that it tends to bear out the view of Cutler,[6] that esophoria is more common in childhood than in later life, the value gradually changing toward exophoria, as shown by the negative correlation."

Eames[7] in a study of 302 cases found an increase of exphoria both at near and 6 M. with age. Roelofs[8] also found an increase in exophoria with increased age. Clark[9] finding less exophoria in 191 college students than the amount usually considered "normal" suggested that special "norms" be set up for this age group. Both Betts[10] and Thomson[11] in studies of school children found a greater percentage of cases of esophoria than is found in the older age groups.

The basic data for the present investigation consisted of 1,192 cases from the files of the clinic, The Ohio State University, School of Optometry. Since the incidence of patients at this clinic was highest in the age group 18 to 30, some selectivity on the basis of age had to be

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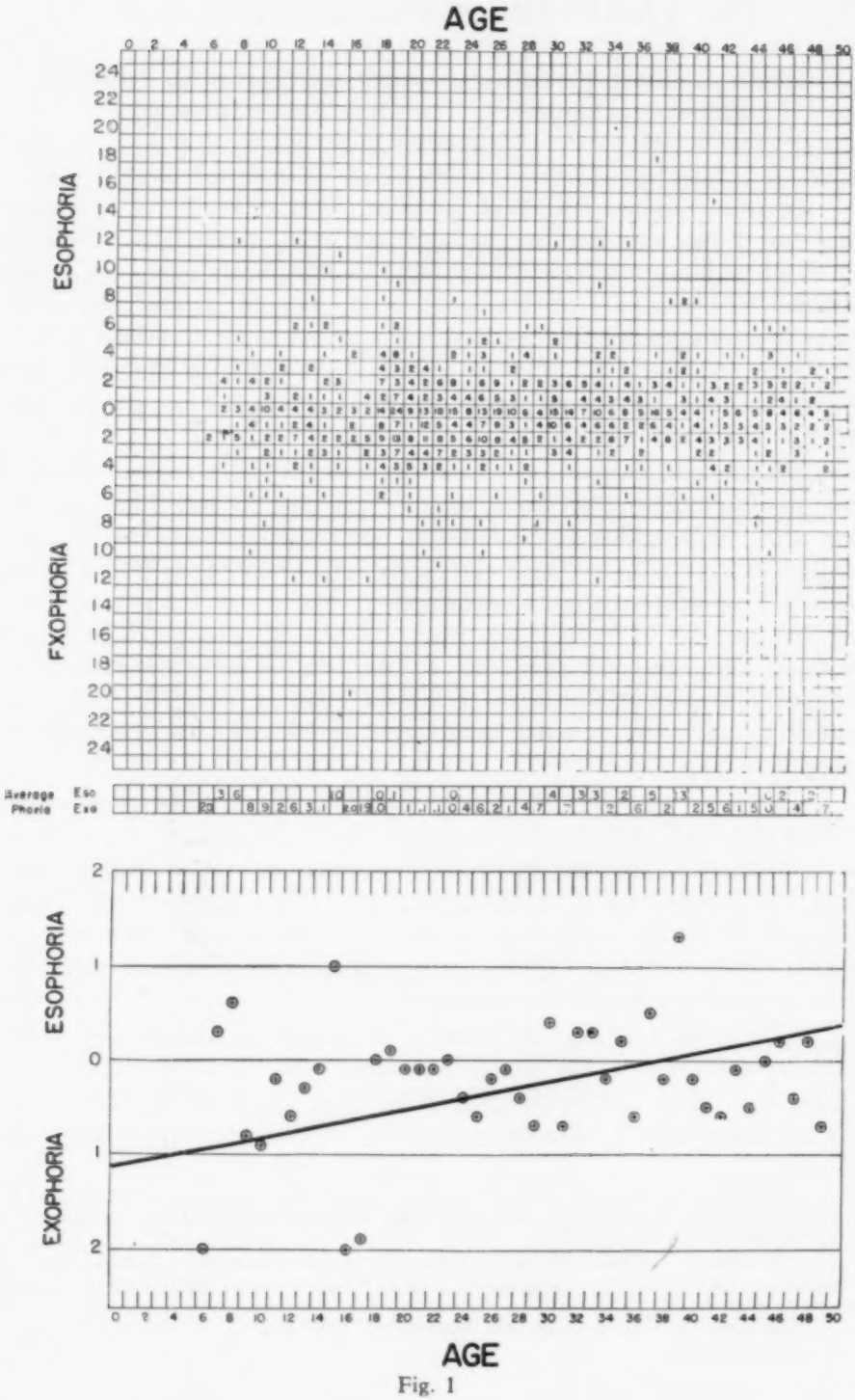
AGE
ESOPHORIA
EXOPHORIA
Average Phoria
Eso
Exo
ESOPHORIA
EXOPHORIA
AGE

Fig. 1

made in order to maintain a representative sampling of all age groups. It should be pointed out that a sampling of cases from clinical files is not a representative sampling of the general population, since clinic patients for the most part have ocular symptoms often accompanied by abnormalities of the visual mechanism. On the other hand, data from a free clinic associated with a university optometry school do include many patients merely seeking a routine examination for the purpose of prevention and hence is probably as close to a true sampling of the population as could be obtained by any means other than a true random sampling of the population.

The phoria at both 6 M. and 40 cm. was measured by the von Graefe prism diplopia method. Since the measurements were made by a number of optometry students, undoubtedly some differences in procedure occurred. However, since there is no reason to suspect errors in a given direction for any single age group, the data is usable insofar as the present study is concerned.

Both the 6 M. and the 40 cm. phoria were measured through the subjective correction and no additional lenses were used. The fact that, in older age groups, the phoria at 40 cm. is usually taken through the subjective correction with no addition of plus lens explains the absence of cases over 50 years of age.

The results are presented in Figures 1 and 2. The upper portion of these figures presents the bivariate frequency distribution; below this is the average phoria for each age level; in the lower part of the figures is presented the graph showing the average phoria values for each age, and also the regression line of phoria on age.

The coefficient of correlation between phoria and age was — 0.075 $\pm$ 0.029 for phoria at 40 cm., and + 0.0796 $\pm$ 0.029 for the 6 M. phoria. The probabilities that such correlations could be due to random sampling from a population in which no correlation existed were .010 for the 40 cm. phoria data and .006 for the 6 M. phoria data. The equations for the regression lines are:

$$P_d = -1.15 + 0.0302\ A \quad (1)$$

$$P_n = -1.93 - 0.0575\ A \quad (2)$$

where P_d is the 6 M. phoria, P_n the 40 cm. phoria and A the age in years. A minus value for phoria indicates exophoria, and a positive value, esophoria. In Figure 3 is presented a scatter diagram for the 40 cm. phoria data. The large number of cases in certain intervals precluded the possibility of presenting such a diagram for the 6 M. phoria data.

The average phorias for 6 M. and 40 cm. at various ages have

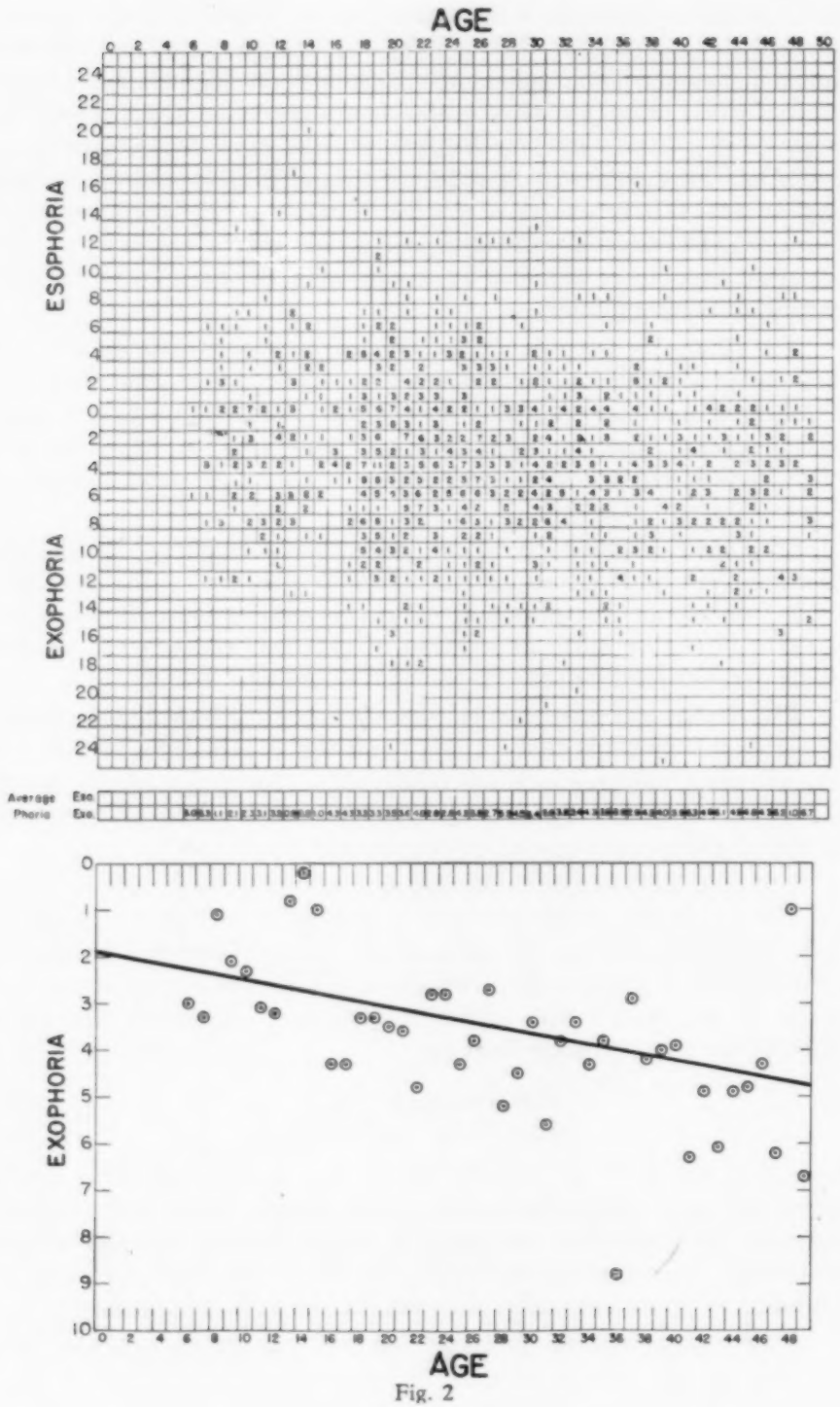
AGE
ESOPHORIA
EXOPHORIA
Average Phoria
Eso.
Exo.
EXOPHORIA
AGE

Fig. 2

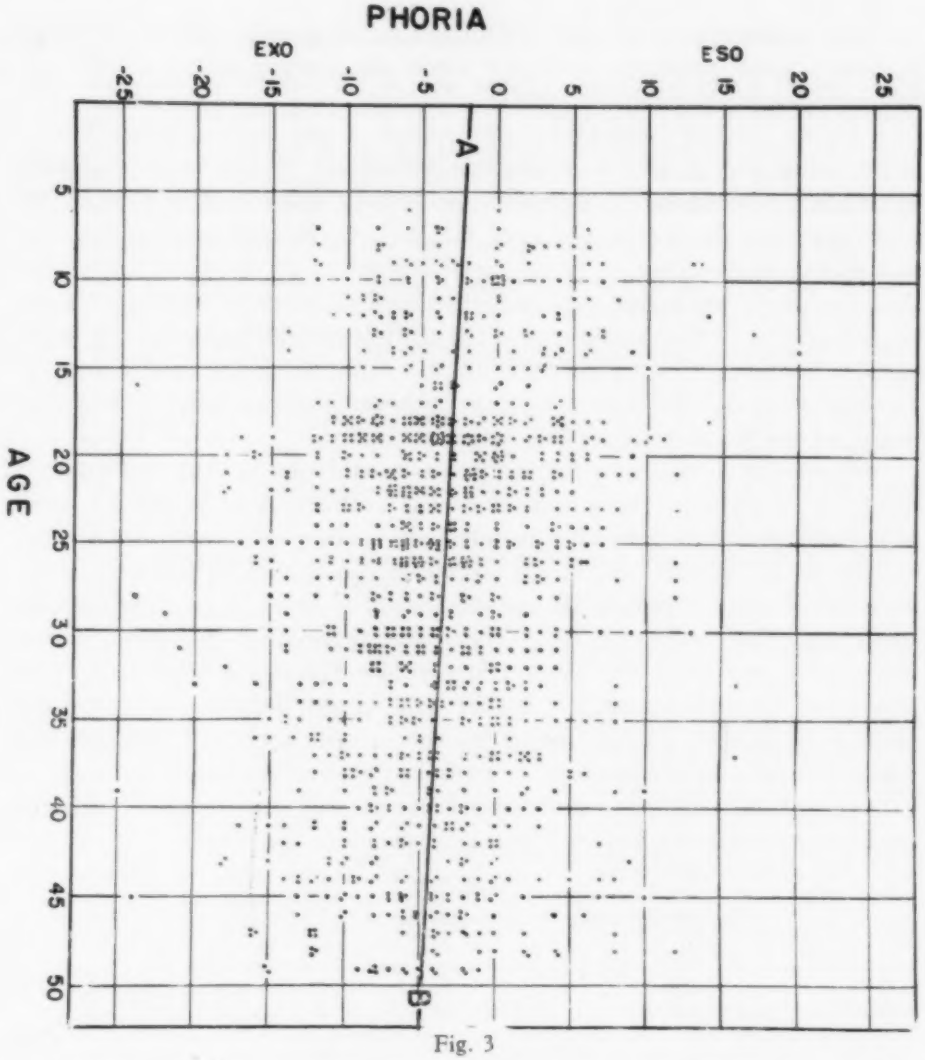

Fig. 3

been calculated from Equation (1) and Equation (2) and the results tabulated in Table I.

TABLE 1

Age	Phoria at 6 M. (△)	Phoria at 40 cm. (△)
5	—1.00	—2.22
10	—0.85	—2.50
15	—0.70	—2.79
20	—0.55	—3.08
25	—0.40	—3.37
30	—0.24	—3.66
35	—0.09	—3.94
40	+0.06	—4.23
45	+0.21	—4.52
50	+0.36	—4.80

From these data it is seen that the average phoria at 6 M. becomes gradually more esophoric with age while the average phoria at 40 cm. becomes gradually more exophoric with age.

If the clinical findings are interpreted in the light of their variability (standard deviation or average deviation) as has been suggested by Haines,[12] Morgan,[13] Shepard,[14] and others, then it is seen that the variation with age is so slight as to fall well within one standard deviation of the measurements. These variations with age therefore have little clinical significance unless rigid interpretation is made of absolute values in clinical data. These variations of the clinical phoria measurements with age do, however, carry theoretical implications as to the mechanism of accommodation. The nature of these implications has been discussed in detail by the present authors elsewhere.[15,16]

Since the preparation of this paper, a study by Scobee and Green[17] has been brought to the attention of the authors. The results of their investigation are in general agreement with the results reported in the present study. Scobee and Green, however, were able to demonstrate a difference in the variation of the phoria at 6 M. with age depending upon sex. Thus, while at 6 M. there was an increase in esophoria for males with age as in the present study, for females it decreased. The phoria at 33 cm. found by Scobee and Green behaved in a similar fashion to that at 40 cm. found by the present authors, although the numerical value of the correlation coefficient was more than twice as high.

The following table summarizes the present status of the problem insofar as correlation between age and phoria is concerned.

TABLE II

Correlation Coefficients Obtained Between Phoria and Age

	N	6 M.	Near
Scobee and Green (males)	217	—0.20	—0.19
Scobee and Green (females)	184	+ 0.17	—0.12
Weymouth, et al	175	—	—0.02 or —0.04
Hirsch, Alpern & Schultz	1,192	+0.08	—0.08

While the agreement for near phoria data is good, the negative correlation at 6 M. found by Scobee and Green for female subjects merits further investigation.

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ABSTRACTS

VISUAL TRAINING, Ward Ewalt, Jr. The Canadian Journal of Optometry, 77-86, March, 1948, and 104-115, April, 1948.

The author points out the need for visual training for that class of patients who cannot be treated satisfactorily by lenses alone. Factors which help to bring about the need for visual training are cited as being the increased visual demands, such as represented by the greater amount of reading required in the primary grades and in college compared with a few decades ago; the increase in the number of popular magazines and novels; the demands in critical seeing occasioned by rapid motor transportation, the automobile and airplane.

The more prevalent types of cases discussed are (1) the convergence insufficiency case, (2) the pre-school or primary grade school child, (3) the squinter and the amblyope, and (4) the retarded reader. The author presents some interesting statistics relative to the incidence of difficulty in reading and refers to the role of deficient vision in delinquent children. Besides visual factors in reading problem cases, reference is made to defective hearing, general health problems, pedagogical factors, language difficulties, and emotional handicaps.

In this article, visual training is defined as: ". . . the reorganization of performance, behavior patterns, to enable the organism to perform more efficiently in its environment." The visual training program is described as: ". . . the teaching of those patterns of achievement which more adequately adapt the organism to its environment."

Fundamentally, the aim of visual training is the adequate arrangement of conditions for learning, much the same as in teacher-pupil relationship, so that increased visual achievement (or skill) is realized with a greater economy of neuromuscular activity. R.E.B.

OCCIPITAL HEADACHES, A. G. McCullar. The Tennessee Optometrist, 2, 4, 5-6, 1948.

From a study of clinical material the author finds that uncorrected oblique astigmatism in moderate amounts is responsible for many cases of occipital headache. This symptom is relieved when the astigmatism is corrected. C.C.K.

OPHTHALMIC MIGRAINE TREATED BY THE TURVILLE TECHNIQUE WITH LOW POWERED BASE-IN PRISMS— A CASE REPORT*

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HISTORY

On August 18, 1946, Mrs. F. R. appeared for an examination with the following complaints: constant supra-orbital headaches extending to top and back of head. These headaches were usually associated with nausea and dizziness. Apparently the patient did not experience the phenomena of flashes of light or blackouts prior to the onset of the headaches. She also complained of an inability to do close work for any length of time. Her present correction is three years old.

The patient has had the usual childhood diseases. There have been no serious illnesses or accidents. Her dental health is claimed to be good. At the present time she is under the care of her physician for "nervousness."

She is a housewife and has no occupational difficulties. She is extremely worried, at the present time, about her son who has recently been inducted into the army.

EXTERNAL EXAMINATION

The external examination is completely negative. Versions and rotations are normal. Convergence to four inches. Finger tension is normal. The pupillary reflexes to light and accommodation are normal.

OPHTHALMOSCOPY

O. U. The media is clear, discs are normal in color and well defined. The physiological cups are of average depth. The blood vessels appear normal, there is no arterio-venous notching. The macula area is normal. There are no exudates nor hemorrhages visible.

REFRACTION

Unaided visual acuity = O.D. 20/15. O.S. 20/15.
Present correction: O.U. + 0.50 D. Sph.
Ophthalmometer: O.U. 0.50 WR 90/180.
Retinoscopy. O.U. + 1.00 D. sph. ⌒ — 0.50 D. cyl. x 180.

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Subjective findings:
O.D. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180.
O.S. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180.

Phoria findings: 3 prism diopters of exophoria at infinity. One-half prism diopter of left hyperphoria at infinity.

Duction findings: Abduction 9/5; Adduction 17/12; Vertical 4/2.

Fusion faculty: Normal.

Accommodation: O.D. 6.5 D. O.S. 6.5 D.

DIAGNOSIS AND TREATMENT

First correction:
O.D. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180.
O.S. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180.

Second correction:
O.D. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180 ⌒ ½ △ base-in.
O.S. + 1.00 D. sph. ⌒ — 0.37 D. cyl. x 180 ⌒ ½ △ base-in.

Upon completion of the examination, the patient was told to wear the first correction for one week; thereupon to return to the office for a check-up examination. At the check-up visit the patient stated that she had experienced a slight amount of relief, but that the symptoms still existed. A recheck of the refraction found no difference; it was therefore decided to consult with the patient's physician. The physician's diagnosis in this case was extremely vague. He attributed her difficulties to one or a combination of three things: Nerves, change of life or migraine. I was inclined to lean more to the "nerves" and "migraine" since "change of life" is rare at age 35. Secondly, the patient was in an extremely nervous state.

I explained to the patient what her physician had said, i.e., that part relative to the eyes, and concluded that we would treat the case as ophthalmic migraine and prescribe base-in prisms.

Giles, in his book *Practice of Orthoptics* states, "Turville has shown the great benefit that can be derived from the prescription of small amounts of base-in prism in cases of migraine, many of which would seem to be ocular in origin. This authority cites over a hundred patients relieved by this method alone when all other means had failed."

Low-powered prisms, usually not exceeding ½ △ base-in before each eye, are incorporated in the distance correction and prescribed for constant wear irrespective of the imbalance. There appears, claims Giles, no known reason why such small prisms should produce such successful results, but Turville's findings cannot be ignored. Turville himself admits the empirical basis of the method. It is possible that at least some of the relief obtained is due to psychological influences, but in

the cases seen by Giles relief has been obtained when every care has been taken to eliminate such effect.

The patient was then told that the prisms might not bring about the desired result. However, since wearing the base-in prisms prescribed in the second correction, the patient has been entirely free of symptoms. It is hard to state whether the relief in this instance is purely psychological or if it is on a psycho-physiological basis.

In three other of the writer's cases, in which the symptoms definitely established the diagnosis of ophthalmic migraine, base-in prisms helped in relieving the distress, after all other treatment had failed.

It might be interesting, in passing, to note that in one case in which base-in prism was prescribed temporarily to relieve poor convergence, the blood pressure, which was extremely high (180/105), was reduced after one week to 150/100. The patient's physician had told him that the hypertension was on a psychogenic basis.

COMMENT

Although the basis for the prescribing of base-in prisms in cases of migraine is not known, the results are. In practically every case where the diagnosis has been established, the results are good to excellent. Many psychiatrists believe that migraine headaches are on a psychogenic basis. If this is true then the base-in prism must have some relieving effect on the nervous system, and it is felt that this relief occurs in the subconscious and not the conscious mind.

SUMMARY

The patient presented herself for an eye examination with the chief complaint of constant headaches associated with nausea and vertigo. The initial correction did not take into consideration the possibility that the headaches were migraine in type. After consultation with the patient's physician, prism base-in was prescribed with complete success, using the technique suggested by Turville in England.

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ABSTRACTS

DISTINGUISHED SERVICES THROUGH SMALL ITEMS, H. P. McDonald. The Iris Bulletin of the Alabama Optometric Association, September issue, 2, 1948.

From a study of clinical material the author finds a variation in the distance between the center of the bridge of the nose to the pupil of each eye. His clinical data show that the right pupil is usually found to be nearer that bridge center line than the left pupil. He urges proper decentration of lenses to compensate for these occasional variations in P.D. distances. V.H.

VISUAL TRAINING IN MYOPIA—A CASE REPORT*

Donald Preble†
Bath, Maine

Patient, girl, 13. When first seen four years ago this student had just received a report from the school authorities that her eyes needed attention. She had no symptoms or complaints. She had never worn glasses nor had she had her eyes examined. She did not realize that her visual acuity was subnormal. There was no history of myopia in the family and the patient was in good physical condition. She was an avid reader.

Visual acuity uncorrected: O.D. 20/200, O.S. 20/200.

Her versions and rotations were good. Near point of convergence was 2 inches.

Pupillary reactions all good. Lid margins and cilia show no evidence of disease or even inflammation. All media clear. Discs well defined. No choroidal crescents. Vessels pursue normal course and of normal caliber. Each fundus was pale. No apparent lesions.

The refractive findings were as follows:

Habitual distance phoria, 3△ exophoria.
Habitual near phoria, 11△ exophoria.
Static retinoscopic findings, O.U. —2.00 D.
Dynamic retinoscopic findings at 20 inches, plano.
Subjective finding, O.D. —2.00 D. sph., O.S. —2.00 D. sph.
Visual acuity with above finding, O.D. 20/20, O.S. 20/20.
Induced phoria, 2△ exophoria.
Distance convergence, 28/10.
Distance abduction, 12/8.
Vertical phorias and ductions, normal.
Near phoria with subjective finding, 7 esophoria.
Crossed cylinder at 20 inches, O.U. —0.75 D. sph.
Phoria with above, orthophoria.
Near convergence, 20/24/16.
Near abduction, 20/28/20.
Tolerance to minus lenses at near, —0.75 D. sph. over subjective.
Tolerance to plus lenses O.U., +2.75 D. sph. over subjective.
Accommodative rock, —2.50 D. sph. (very slow).

The patient had no objection to wearing glasses but her mother was very much against the idea. She had heard of visual training to "reduce" myopia and that is what she wanted. After carefully explaining to her that the results were very questionable with such a degree of

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myopia she still insisted upon it and promised everything in the way of cooperation.

The patient was very cooperative. From November until the following May she was given three treatments each week. Meticulous records were kept of the techniques used and the results obtained at each treatment period. The techniques followed were those recommended by the Optometric Extension Program.

After six months of visual training the patient claimed she could see much better but her vision was not normal enough to suit her. It was interesting to note that at this time she had become "vision conscious." Six months before her visual acuity was 20/200 and she was seemingly unaware of the blur which was present. Six months later her vision was 20/40 O.U. uncorrected but she complained of the blur which was present. At this time her refractive findings were:

Static retinoscopic findings, O.U. —3.00 D. sph.
Subjective finding, O.D. —3.00 D. sph., O.S. —3.00 D. sph.
Visual acuity with above finding, O.D. 20/20, O.S. 20/20.
Induced phoria, 2△ exophoria.
Distance convergence, 28/20.
Distance abduction, 20/12.
Vertical phorias and ductions, normal.
Near phoria with subjective finding, 2△ exophoria.
Crossed cylinder at 20 inches, O.U. —1.00 D. sph.
Near convergence, 20/24/16.
Near abduction—no blur or break up to the limit of the phoropter.
Tolerance to minus lenses at near, —2.25 D. sph. over subjective.
Tolerance to plus lenses, O.U. +2.25 over subjective.
Accommodative rock, —2.00 D. sph.

During the past six months she had been trained with most of the visual rehabilitation techniques including a correction consisting of +1.00 D. sph. over one eye and a frosted lens before the other in an attempt to break down binocular association. The writer used these techniques as taught by Dr. A. M. Skeffington.

The patient's vision without lenses improved from O.U. 20/200 to O.U. 20/40. At the same time, however, the amount of concave sphere necessary for her to see O.U. 20/20 had increased from —2.00 D. sph. to —3.00 D. sph. The visual training which was prescribed had without question improved her visual acuity, but at the same time, her myopia had increased. However, the patient's esophoria at the near point was gone and her tolerance to minus lenses over and above the subjective finding was greatly increased. The writer is inclined to think that her visual acuity at O.U. 20/40 would have been satisfactory and would have enabled her to get along without correction, but this was not satisfactory to the patient, and at that time, her mother would still not consent to the patient's wearing glasses.

Visual training was continued for several additional weeks until the patient's uncorrected visual acuity was O.U. 20/30. It was interesting to note at this time the patient had 20/30 vision either without a correction or with a —2.75 D. sph. O.U. To improve vision to O.U. 20/20 required the addition of O.U. —0.25 D. sph.

The writer made a number of check tests to verify these findings and is confident the patient was not malingering. Despite these findings, the patient was still not satisfied with her uncorrected vision. It was probably true that to achieve this visual acuity it was necessary for her to concentrate considerably more than ordinary and at this point, it was agreed that the training periods would be discontinued. The writer then prescribed O.U. —3.00 D. sph.

While this case was a failure as far as training goes, I feel that the time and effort were not entirely lost because of the change which took place in the patient's near point finding. Subsequent events proved that she could wear the O.U. —3.00 D. sph. correction for distance as well as near point work without an increase in the myopia as subsequent refractions have shown no change in her correction during the past three years.

The writer finds the foregoing case to be typical of his training experience with myopic patients. The vision improves but the myopia does not reduce in amount. In a number of these cases the findings indicate that the balancing of the near point findings seems to assist in stopping the progression of the myopia.

ABSTRACTS

A CLINICAL STUDY OF THE RECOVERY POINT, M. H. Trost and H. Liachowitz. Alumni Bulletin of the Pennsylvania State College of Optometry, 2, 6, 1-8, 1948.

In phoria and duction testing prisms are used. The authors observed that various levels of accommodation are utilized by patients in reporting their findings. They also noted that when a blurred target was reported that this could be cleared by a reduction of the prism power. This study was made to determine the amount of the difference in prism power at the point of binocular fusion between the blurred recovery point and the clear recovery point. Thirty subjects were used. The authors' data indicate that in those cases which report a blurred recovery point the average difference between this finding and the clear recovery finding is from two to four prism diopters. About 30 per cent of the subjects fell into this group. Six tables.

C. C. K.

A BASIS FOR FEES FOR OPTOMETRIC SERVICES, H. Bookstaber. Journal of the New Jersey Optometric Association, New Vol. 2, 9, 1, 1948.

The author recommends an overall fee of $15 for complete optometric service including examining, refracting, prescribing and all subsequent services such as verifying the prescription, and immediate and future adjusting of the material. To this professional fee he suggests adding the cost of the materials as received from the laboratory. With this fee schedule, the author claims today's living costs can be properly met in the average practice on a fully professional basis.

V.H.

CATARACTS AND RETINAL DEGENERATION—A CASE REPORT*

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I. CASE HISTORY

OCULAR HISTORY

The patient is 31 years of age and states that he has always had "weak eyes" and began wearing glasses at an early age. He states that he has always had a certain amount of difficulty seeing in dim illumination and that this condition has become progressively worse. The present correction worn by the patient is O.D. — 5.25 D. sphere, O.S. — 4.25 D. sphere. Distance acuity is O.D. 20/80, O.S. 20/50, O.U. 20/50, with correction. Distance acuity without correction O.D. 20/260, O.S. 20/200, O.U. 20/200.

The patient reports that he served in the United States Army (World War II), for 14 months, having been drafted. He was not required to sign any waiver or told that he had any ocular anomaly at the time of his induction. He spent most of his army career operating a heavy duty crane. After being in the army 14 months, he found it necessary to remain in his bunk after sundown because of an inability to see well enough to get around unassisted. This resulted in his discharge from the army for "weak eyes." He was given a medical discharge but received no disability pension.

HEALTH HISTORY

The patient reports that other than poor vision he has always been in perfect health, having had no serious illuess. During his youth he lead a normal active life. He has undergone no major operations. His dental history is satisfactory. He mentions a difficulty at present in walking if he is not familiar with the terrain.

FAMILY HISTORY

The patient reports that he has an uncle who also has "bad eyes." The patient also has a cousin who has a similar condition. The patient's mother and father have no ocular disturbances. He has a brother who is also normal with respect to vision.

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SCHOOL HISTORY

The patient did not have a very complete education. He attended rural county elementary school but did not finish high school. This was probably not due entirely to his abnormal vision but more to financial necessity, a common cause in this region.

OCCUPATION

The patient is a farmer by occupation. The work is not mechanized but sheer manual labor.

COMPLAINT

The patient's complaint is: "I cannot see as well as I could. I want to know if I can get some contact lenses to make me see better. I am afraid about my eyes and want to do whatever I can to see better." The patient had read of contact lenses in a syndicated newspaper article. He had inquired about these lenses from another practitioner and subsequently came to my office.

II. PRELIMINARY FINDINGS

EXTERNAL EXAMINATION

External examination reveals the lid edges to be healthy, the puncta clear, lid action normal. The conjunctiva, both taral and bulbar, is clear. There are no signs of injection. The cornea is clear with no opacities or vascularization apparent. The iris appears to be normal. The pupillary reaction to light is satisfactory both directly and consensually. The pupil has a definite hazy appearance. Palpation test indicates no increase in intra-ocular tension.

ROTATIONS AND VERSIONS

The patient has no apparent difficulty with convergence, the near point being about 6 centimeters. Rotations show no restrictions monocularly or binocularly. The patient has some difficulty following the source if it is moved too rapidly, however.

III. OPHTHALMOSCOPIC AND OTHER TESTS FOR PATHOLOGY

THE RIGHT EYE

Ophthalmoscopic examination of the right eye shows the cornea to be free of any inflammation and opacities. The anterior and posterior chambers are clear. The iris surface is smooth and its pupillary edges smooth. There are no adhesions. The lens, however, has a well developed cataractous condition. The cataract is diffuse and appears to be made up of small bluish white particles. The cataract is of the type that might well be congenital. This is substantiated by the case history. Accurate observation of the vitreous chamber and the fundus proper is

most difficult as the cataractous degeneration is wide spread. Indistinct as it is, it is possible to see that the retinal vessels are very narrow. The fundus ground is a pale red. Irregular stellate shaped pigment cells can be seen toward the periphery.

THE LEFT EYE

The ophthalmoscopic examination of the left eye reveals a similar clinical picture as described above for the right. The cataractous condition of the lens in this eye, however, is not as fully developed and a slightly clearer picture of the fundus is obtainable. The finer branches of the very narrow arteries and veins are hardly visible. The fundus ground is pale. The disc has a waxy appearance. The stellate shaped pigment deposits can be seen toward the periphery.

CONFRONTATION TEST

The confrontation test shows a definite concentric shrinking of the fields of vision. This is quite marked but hardly so much as to classify the patient as having tunnel vision. This is a likely explanation of the difficulty the patient now experiences in walking when it is necessary for him to watch the ground.

IV. DIAGNOSIS

The patient has binocular cataracts which apparently are congenital in origin. There is fundus pathology in both eyes. The restricted fields, the diminution in size of the retinal vessels, the discolored disc, pale fundus ground and the stellate pigment figures are all indicatory of primary pigmentary degeneration of the retina. The case history of difficulty in dim illumination and the familial occurrence further bear out this diagnosis.

V. PROCEDURE ADOPTED

It is obvious that the patient's condition does not fall within the scope of optometric practice. The pathological condition is an absolute contraindication for contact lenses. The remaining problem is how to best aid the patient.

As stated above in the case history, the patient was honorably discharged from the army because of the condition of his eyes. He is, therefore, eligible for medical care by the Veterans Administration, as his condition was aggravated by or progressed, during the time he was in service. The local Veterans Administration verified this and offered all possible assistance. This official gave the name of a local ophthalmologist who examines such cases for the Veterans Administration.

The patient was referred to this practitioner, R. L. Lucas, M.D., Anniston, Alabama. This physician was to determine if the patient

should be admitted to a veterans hospital for observation and possible further treatment.

Subsequent examination by Dr. Lucas verified the diagnosis as described above. The possibility of cataract operation was discussed but this was ruled out as the primary pigmentary retinal degeneration eventually will lead to blindness. There was also discussion as to how an individual with either of these two pathological conditions was inducted into the service.

Proper forms for admission to a Veterans Administration hospital were made out for the patient. The possibility of the patient receiving any treatment at the hospital is not very likely. The prognosis in this case is very poor and blindness is almost inescapable.

The patient will receive a pension allowance based in some manner on the loss of vision which occurred during the time of his service in the army. His condition would probably have progressed just as rapidly had he remained a civilian. However, the failure to reject him at the time of his induction examination would seem to make the government responsible.

VI. SUMMARY

The patient was referred to the writer for consultation concerning contact lenses. The patient had acquired a desire for such lenses by reading articles in magazines and newspapers and felt that such lenses might help him. The patient had previously been discharged from the Army because of "poor vision." Ophthalmoscopic examination revealed the condition of binocular cataracts and fundus signs indicatory of primary pigmentary retinal degeneration. The patient was referred to a local ophthalmologist who handles such cases for the Veterans Administration. The patient was given admission papers for a veterans hospital where he will undoubtedly be pensioned.

204 COMMERCIAL NATIONAL BANK BUILDING,
ANNISTON, ALABAMA

ABSTRACTS

ECONOMIC SURVEY OF OPHTHALMIC COSTS, D. W. Conner. The Journal of the Indiana Optometric Association, 20, 6, 13, 1948.

The author conducted a survey of optometric fees among the optometrists of six Indiana counties. The men included having been in practice during the period 1942-1948. Of the total practitioners in the area, 70 per cent were included and the author feels this large group to be representative of the total. The findings, which included charges for examination as well as ophthalmic materials, showed that in comparing the 1942 fee schedules and the 1948 schedules, optometrists had raised their average fees only 19 per cent during this period while during the same period the charges for laboratory work had increased 29 per cent. Other cost of living increases are quoted by the author. One table. V.H.

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WASHINGTON INSTITUTE OF MEDICINE

"Professional practitioners of optometry are now eligible to apply for membership in the Washington Institute of Medicine," said Dr. Henry J. Klaunberg (Ph.D.), Institute Director, during a visit to the Journal office, October 13.

Dr. Klaunberg was accompanied by Dr. Lewis H. Kraskin, (O.D.). Both are from Washington, D. C.

According to Dr. Klaunberg, membership in the Institute is limited to physicians, research workers, educators and now optometrists who meet all professional qualifications and requirements as outlined by the Institute.

"Membership will be of particular advantage to the serious student of refraction," Dr. Klaunberg pointed out. "The aims of the Institute

are educational and its services to its members are entirely within this field," he claimed.

According to Dr. Kraskin, the membership requirements of the Institute are quite similar to those of the American Academy of Optometry. Dr. Kraskin pointed out that the Institute would elect to membership only those optometrists whose practices were individual and which were conducted on the highest ethical plane. "All applications will be carefully reviewed before being acted upon," Dr. Kraskin said.

Members of the Institute receive the following services:

(1) A consultation service in which the member may request data on any topic dealing with refraction.
(2) The Institute staff will compile bibliographies covering any period of time on ocular subjects for a very small fee.
(3) Members can secure available reprints or abstracts without cost.
(4) Foreign language papers will be translated for a small fee.
(5) Each member will receive the *Quarterly Review of Ophthalmology and Allied Sciences.*

Dr. Klaunberg pointed out that "to the research worker in optometry the first four of these services will prove invaluable and the optometrist in practice will find the *Quarterly Review of Ophthalmology and Allied Sciences* a work of real value."

In this the writer is in complete agreement. I have in my library a complete file of the Quarterly Review and find it a valuable aid in keeping abreast of current literature and as a modern reference work. The Quarterly Review is now in its fourth year. It is edited by Dr. Conrad Berens, ophthalmologist of New York City, assisted by a board of leading specialists. Four optometric educators serve on this board.[1] This quarterly abstract journal is published by the Washington Institute of Medicine for its members. The Institute issues similar abstracting services for a number of medical specialties.

The Quarterly Review presents a condensation of most of the contemporary writings in the ocular field. These abstracts make possible a quick review of current literature. The availability of this material is a shortcut of considerable value to the optometrist.

While it is true that there is no substitute for the original paper where the complete study of the author is presented, this abstract service enables the reader to rapidly review the current literature and decide which papers he wishes to study in their entirety.

Eligible optometrists are therefore encouraged to apply for membership in the Institute. The annual fee is $30.00 a year. Applications should be sent to the Washington Institute of Medicine, 1720 M Street, Washington, D. C.

CAREL C. KOCH

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1 Huck, Virginia. Optometrists in the News. Am. J. Optom. Arch. Am. Acad. Optom. 25, 7, 358, 1948.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

REPORT OF OPTOMETRIC MUSEUM COMMITTEE

In May, 1947, at the annual meeting of the Academy, a Museum committee was appointed to investigate the possibility of establishing an optometric museum at the Ohio State University. The following is the first report of the committee's recommendations which have been approved by the Executive Council.

During the past few years the School of Optometry at the Ohio State University has gathered and received a number of items suitable as museum pieces of special interest to optometrists. These have been stored away with the hope that eventually space, facilities, and assistance could be provided for developing and maintaining a worthwhile museum.

Recently the idea that such a project should be given special support has been promoted by several members of the American Academy of Optometry. The Academy has indicated its willingness to sponsor or aid such a project at the Ohio State University by creating a special committee to negotiate for arrangements toward an endowment and to make recommendations to the Academy at its next annual meeting. The committee has drawn up the following tentative classifications of items to be considered for such a museum.

1. Early ophthalmic instruments and equipment employed in refraction, diagnosis, treatment, and spectacle fitting.
2. Early optical and ophthalmic manufacturing and assembling equipment.
3. Rare books and incunabula dealing with vision, optics, and light.
4. Famous manuscripts, protocols, and documents bearing on the history and background of optometry.
5. Portraits and statuary of optometric forefathers, leaders, and pioneer thinkers.
6. Early spectacle lenses and mountings.
7. Early ophthalmic and optical aids other than spectacles.
8. Photographs, illustrations, and artwork depicting early optometric schools, practices, techniques, spectacles, etc.
9. Letters, papers, and personal belongings of optometric leaders and forefathers.

10. Representative diplomas, licenses, educational franchises, charters, and honor certificates.
11. Early patent records.
12. Miscellaneous publication clippings and historical notes bearing upon optometric history and background.
13. Glass artifacts.
14. Originals and replicas of apparatus designed for or used in early experiments in vision, optics, and light.
15. Early optometric teaching aids.

The Committee for the Establishment of an Optometric Museum

E. LeROY RYER, CHAIRMAN
R. M. HALL
H. W. HOFSTETTER

CONVENTION PLANS COMPLETED

Forty days 'til Christmas, but only 10 days until those special trains will be rolling to a stop at points east, west, north, and south to pick up convention-bound Academy Fellows. Dr. John Perry, Jr., writes that the Winston-Salem chapter is all set to show the Academy members a good time, and Dr. Harold Simmerman, and his program and papers committee have a top-flight technical program scheduled. There will be 18 lectures, special panels on aniseikonia, contact lenses and orthoptics, a luncheon for chapter representatives, and of course, the annual round table banquet with a special speaker—Dr. F. M. Foote, Executive Director of the National Society for the Prevention of Blindness.

CANDIDATES TO BE EXAMINED

In keeping with Academy custom, the examining committee will conduct special examinations at the annual convention for candidates who have applied for Academy Fellowship. These candidates have already been notified by mail to be on hand at Winston-Salem, according to Dr. Richard M. Hall, committee chairman.

IT'S SOUTH ALL RIGHT, BUT . . .

When packing for the trip, keep in mind that Winston-Salem has an average of 232 clear days a year, an average mean temperature of 58.2 degrees; the temperature ranges from a norm of 38.5 degrees for January to a norm of 77.5 degrees for July; rainfall averages 44.88 inches a year and the average snowfall is 7.8 inches—all of which adds up to the fact that the North Carolina climate may be mild, but you'd better take along warm clothing as well as light. And don't forget, the banquet is formal.

BOOK NOTICES AND REVIEWS

Books received are acknowledged by notices in this department. Special selections will be made for more extensive review in the interest of our readers as space permits.

OPTOMETRY—PROFESSIONAL, ECONOMIC AND LEGAL ASPECTS. Hofstetter, Henry W., O.D., Ph.D., F.A.A.O. (Ohio State University), The C. B. Mosby Co., 3207 Washington Blvd., St. Louis, Mo., 412 pp., $6.50, 1948.

Although this book was written primarily for undergraduate students in optometry, it will fill a much-needed service for optometrists in general, and for those in other professions who wish to become familiar with the various nonclinical aspects of the practice of optometry. The topics that are covered include: The historical background of optometry, legal status of optometry, jurisprudence, economics, professional and inter-professional relationships, educational and organizational problems, practice management, ethics, and general civic and sociological problems of vision and eye care.

Heretofore, a comprehensive and authoritative book with such important factual data, references, surveys, statistics, and unbiased opinions had not been available. The subjects discussed are treated inadequately in most of the optometric schools. Optometric students, teachers and practitioners will find in Hofstetter's book all the non-clinical aspects relevant to the optometric profession.

Of special importance are the discussions on the optometrists' legal privileges and limitations; the prevalence of visual anomalies in this country; the role of the optometrists in the prevention of blindness; the national and local governmental relationships of optometry; the scope of optometry; and public eye health education. The treatment of these subjects, as well as of the other material, is presented objectively in a scientific but easily readable style.

This book should prove of value to all optometric students as a textbook; to teachers as an up-to-date reference book; to practicing optometrists as a handbook on non-clinical information; and to vocational advisors and others interested in the professional, economic, and legal aspects of optometry. ROBERT E. BANNON

THE OPTICS OF OPHTHALMIC LENSES. Meredith W. Morgan, O.D., Ph.D., F.A.A.O., and Henry B. Peters, O.D., Ph.D. Published by the Associated Students Store, University of California, Berkeley, California. Ninety-six pages; photolith type, lithographed; illustrated; board covers; 1948.

This book is the text used in courses 401A and 401B at the School of Optometry, University of California. The text is clearly written and well illustrated. Among other things the authors have included a wealth of statistical material on lenses. CAREL C. KOCH

MANUAL OF PHYSICAL AND GEOMETRICAL OPTICS. Frederick William Sinn, O.D., F.A.A.O. Published by the Press of the Pennsylvania State College of Optometry, 12th and Spencer Avenue, Philadelphia, Pennsylvania; 218 pages; offset lithography; illustrated; board covers; 1948.

This book is one of the texts used in courses in geometrical optics at the Pennsylvania State College of Optometry. It consists of a series of questions and answers grouped in their logical classifications. It is well illustrated. This text will be of considerable value to members of state boards of optometry as well as to students. CAREL C. KOCH

HOW TO SUCCEED IN OPTOMETRY. Ralph Barstow, Professional Counselor, Optometric Extension Program. Published by the Augsburg Publishing House, 425 South 4th St., Minneapolis, Minnesota; 276 pages; illustrated; first edition limited to 1,000 numbered copies; cloth, $10; 1948.

For years this author has been a staff writer for the Optometric Extension Program. Subscribers to this educational service are familiar with Barstow's monthly "Practice Development" series to optometrists. The current text is an outgrowth of his writings for the O. E. P. It is particularly directed to the graduate about to enter practice and is full of worthwhile suggestions for him to follow. This book is highly recommended. CAREL C. KOCH

REFRACTION OF THE EYE. Alfred Cowan, M.D. Published by Lea and Febiger, Philadelphia, Pennsylvania; third edition; 287 pages; illustrated; 3 color plates; cloth; $5.50; 1948.

This is an orthodox text book on refraction. It is very well written and is in use as a text at the Graduate School of Medicine, University of Pennsylvania. The author has brought the manuscript up to date in this third edition. CAREL C. KOCH

MEDICAL WRITING, THE TECHNIC AND THE ART. Morris Fishbein, M.D., Editor, Journal of the American Medical Association, and Jewel F. Whelan, Assistant to the Editor, Second Edition,

published by the Blakiston Company, 1012 Walnut St., Philadelphia 5, Pa., 292 pages, illustrated, cloth, $4.00, 1948.

The purpose of this book is to assist those who write scientific articles. The book deals with manuscript construction, style of writing, spelling, abbreviations and rules for capitalization, proofreading and indexing. It also serves as style book for the publications issued under the editorial supervision of the American Medical Association. As the rules of outline and orderly development of thought in an article as well as the rules of sentence construction and grammar apply to all scientific writing, optometric authors will find this text of value.

CAREL C. KOCH

PRINCIPLES OF PERSONNEL TESTING, C. H. Lawshe, Jr., Professor of Psychology, Purdue University, published by McGraw-Hill Company, 330 West 42nd St., New York, N. Y., 227 pages, illustrated, cloth, $3.50, 1948.

The author presents the procedure for selecting, validating and using personnel tests in industry. These tests include mental, personality, preference and visual skills. The text has chapters dealing with special tests for mechanics, clerical workers, sales people and supervisory staff. The book was written at Purdue where the author is one of a small group who has specialized in this activity. This book should be required reading for optometrists working in industrial health programs.

CAREL C. KOCH

THE ANATOMY OF THE EYE AND ORBIT, Eugene Wolff, Ophthalmic Surgeon and Pathologist, Moorfields Hospital, London, published by the Blakiston Company, 1012 Walnut St., Philadelphia, Pa., 439 pages, illustrated, 24 color plates, cloth, $12.00, 1948.

This is the author's third revised edition. The author presents the orbit, eyeball and tunics; the extrinsic ocular muscles and nerves; the involuntary nervous system and the accommodative convergence mechanism. In all, this is a well written and illustrated text with many up-to-date British plates.

CAREL C. KOCH

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

INTERNATIONAL HEALTH PROGRAMS

From press reports it is often difficult to detect that the United Nations is carrying on any constructive work. But behind the cloud of vetoes, charges and countercharges which hangs over the assembly room at Lake Success, there are many committees quietly planning a better world.

Among these is the little publicized United Nations World Health Organization. Under the auspices of this committee, a World Health Assembly met in Geneva, Switzerland, during June and July to discuss strengthening of health organizations and eradication of disease on an international level. Delegates from 70 countries were present, the United States joining at the last minute.

While an organization such as this is obviously concerned for the most part with communicable diseases, it is to be hoped that providing the U. N. survives the critical period ahead, eventually the WHO will turn to more specific problems such as, for example, the standardization of ocular terminology on an international basis.

At the moment, however, the agenda calls for committee work on housing, industrial hygiene, tropical and rural hygiene, drug addiction, alcoholism and similar problems of vital concern to the world.

MASSACHUSETTS SCHOOL OF OPTOMETRY

In line with a decision to extend its optometry course from four to five years, the Massachusetts School of Optometry has revised its entrance requirements, Dean Ralph H. Green reports. Starting September, 1949, the minimum requirement for admission is the satisfactory completion of one year of pre-optometry at an acceptable college of arts and sciences, which year must include English composition, algebra, plane trigonometry, general biology, inorganic chemistry, and electives to round out a total of 30 semester hours.

The last class to enter Massachusetts under the four-year plan was admitted in September of this year.

STUDIES IN VISUAL ACUITY

On sale at the United States Government Printing Office are copies of "Studies in Visual Acuity, 1948." The price is $1.00 less a 25

per cent discount on orders over 100. Orders, accompanied by a check or money order, should be directed to Superintendent of Documents, Procurement Section, United States Printing Office, Division of Public Documents, Washington, 25, D. C.

FACULTY CHANGES

Transferring their teaching activities from the midwest to the Pacific Northwest are Dr. Richard Feinberg and Dr. Harold M. Haynes, both of whom have accepted positions recently on the staff of the Pacific University's School of Optometry.

Dr. Feinberg became Professor of Optometry and Executive Secretary of the school this fall after receiving his Ph.D. in applied psychology at Purdue University. Dr. Feinberg served as research associate and consultant to the Industrial Vision Institute while at Purdue.

Dr. Haynes' appointment to the Pacific staff was announced in October by Dr. Feinberg. The former Northern Illinois associate professor will not only teach at Pacific but also carry on research in visual training. Dr. Haynes was director of the visual training research laboratory while at Northern Illinois, in addition to teaching.

Dr. Henry W. Hofstetter of Ohio State University also reports he is accepting a new teaching position. On January 1, 1949, Dr. Hofstetter will take over the directorship of Research and Education at the Los Angeles School of Optometry.

NEWS BRIEFS

Back in publication after a five-and-one-half-year war recess is the *New Zealand Institute News*, the official magazine of the Institute, with news and views of New Zealand ophthalmic opticians (optometrists). . . . Veterans now studying under the GI bill for the profession of optometry numbered 4,746 by recent count. . . . The American Optometric Association has recently released six timely optometric news features covering visual problems to newspapers of the nation. Quoted are A. O. A. President Dr. John B. O'Shea of Northampton, Massachusetts; Dr. Marguerite Thoma Eberl, Milwaukee, Wisconsin; Dr. Elmer M. Soles, McKeesport, Pennsylvania; Dr. E. H. Westland, Ambridge, Pennsylvania. . . . The Better Vision Institute is planning a stronger-than-ever radio, newspaper and magazine campaign for 1949 to educate the American public on proper visual care. . . . Pacific University optometry students swelled the coffers of the university's building fund by several hundred dollars when they donned blue jeans and boots and picked nuts for a local firm between classes.

—Sensibly, smartly styled, Princeton Ful-Vue with Arch features popular P-3 eye shape. Available with rigid ts or with new one piece construction adjustable arm pads. English or regular hinge.

Distinctive Princeton Ful-Vue with Prep bridge. Bay famed craftsmanship assures qualities of lasting satis- through greater comfort and better appearance. ble with English or regular hinge.

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Princeton Medium Weight frame has perimetric eye nd English hinge. Splendid for men and women desiring g slightly heavier than average frame. Supplied with ype temples.

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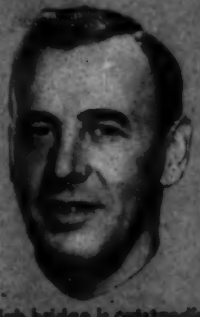
Patient has fairly wide bridge and average temples. Prefers more conservative styles as indicated by natural eyebrows, longer hairdo.

Young, masculine type with oval face. Nose is wide at bridge, does not taper in usual manner.

Patient has fairly narrow bridge, wide temples. Does considerable reading, sewing and close work.



High bridge is outstanding fitting characteristic of this patient, together with long, angular face.

(ANSWERS ON NEXT PAGE)

HERE'S THE RIGHT ANSWER

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High bridge and narrow face of this patient were easily fitted with Princeton Ful-Vue. Prep bridge hugs snugly around nose. Patient especially liked all around quality of this frame which makes it suitable for all types of wear.

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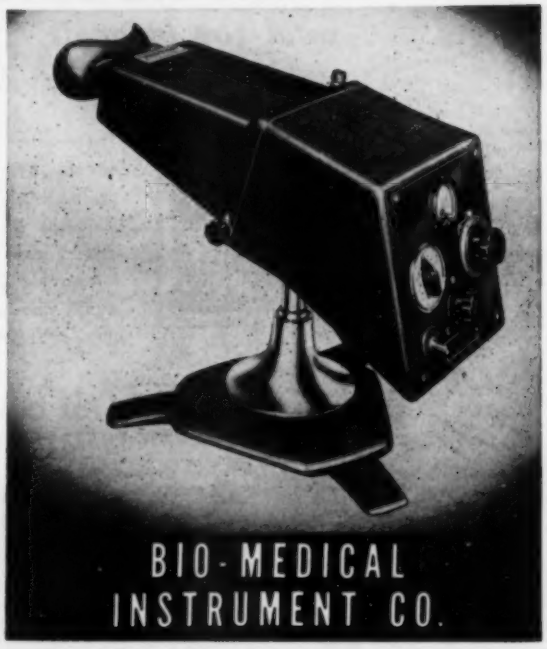

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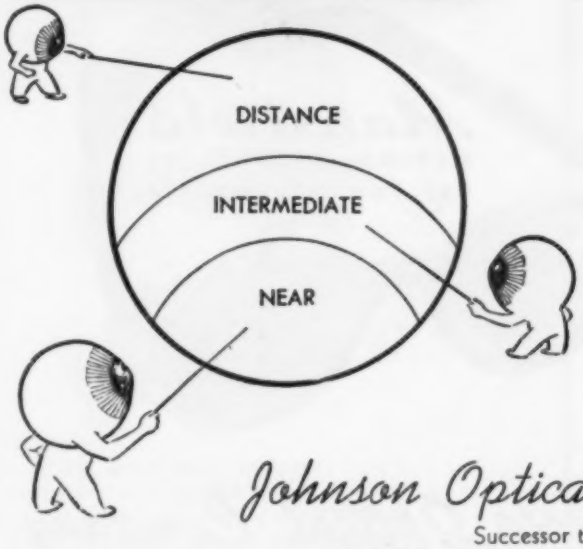

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The Law of Identical Points	Binocular Color Mixture

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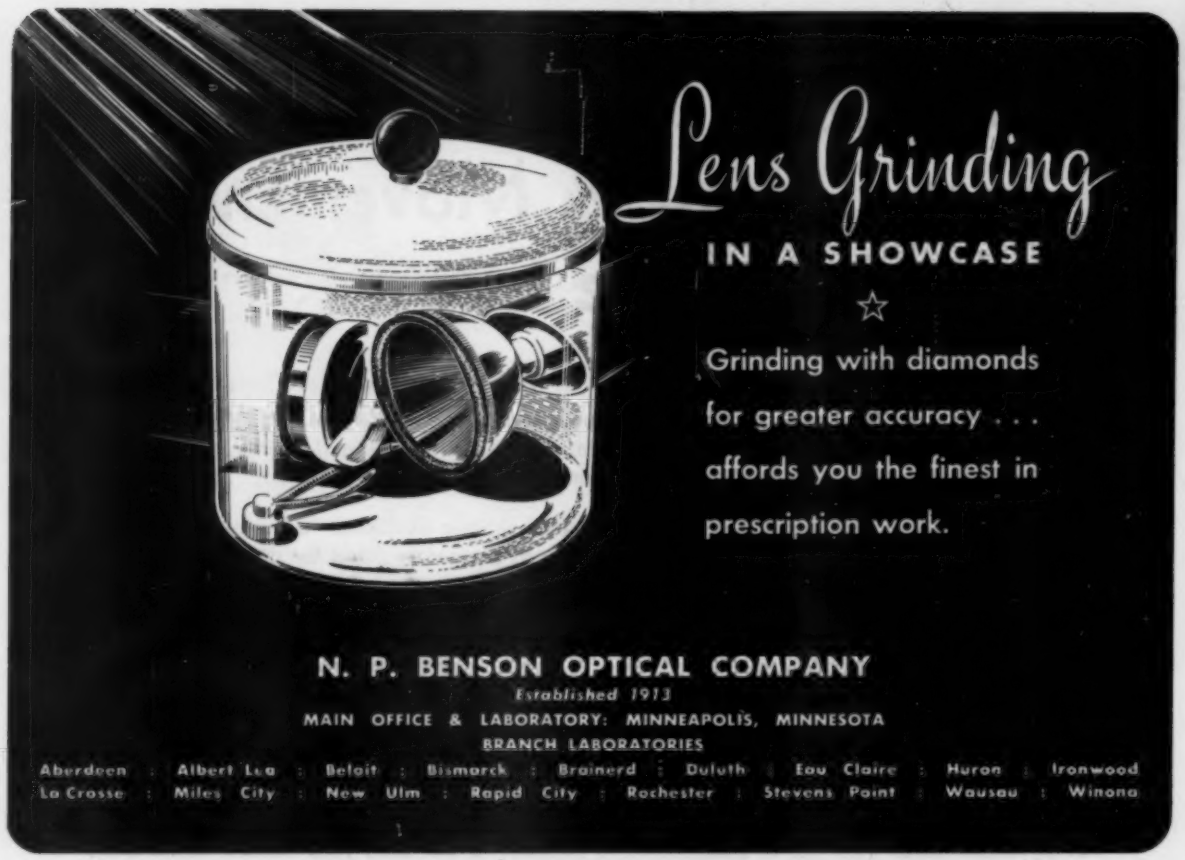
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AVAILABLE MONOGRAPHS (Supplemental List)*

The American Academy of Optometry has available a limited number of reprints of the following original papers. These monographs, printed with special board covers, will be mailed, postpaid, to professionally interested persons upon receipt of order and the cost of reprint. Selection should be made by number. American Academy of Optometry, 1502 Foshay Tower, Minneapolis 2, Minnesota.

☐ Monograph No. 1A. Robert E. Bannon. Heterophoria and Aniseikonia. 16 p. + cover. Price 25c.

☐ Monograph No. 1B. Robert E. Bannon. On the Technique of Measuring and Correcting Anisekonia. 24 p.+ cover. Price 35c.

☐ Monograph No. 26. Eugene Freeman and Milton Freeman. The Optometric Impression Technique in the Fitting of Contact Lenses. 36 p. + cover. Price 50c.

☐ Monograph No. 37. Robert E. Bannon. The Use of Cycloplegics in Refraction. 56 p. + cover. Price 75c.

☐ Monograph No. 38. J. Donald Kratz. Two Important Diagnostic Points in Tropias. 12 p. + cover. Price 20c.

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